Strategies to Enhance the Likelihood that Teachers Will Integrate Technology into Their Classrooms

by

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ABSTRACT

This study examined the factors that enhance the likelihood that teachers will integrate technology into their classrooms. Starting with a historical perspective on technology integration, the study categorized these factors and shed light on which ones have become obstacles. If obstacles or barriers are identified, then eliminated or at least minimized, the likelihood of teachers' integrating technology into their classrooms may become a more promising realization. Another integral part of this study discussed strategies utilized in models of teacher professional development with the intent of identifying which approaches or models, or combinations thereof, had the best chance for successful implementation. The literature suggested that traditional or standard professional development approaches have not proved very successful. School-based and self-directed models, having evolved somewhat over the years, have shown more promise, although no singular approach can be recommended to suit schools overall. Instead, a combination of these approaches, as well as the addition of a student-based approach was recommended. The goal of this study was to provide data that may be used to create new alternatives for training educators. This study adds to the limited research regarding effective teacher professional development in the area of technology integration. Schools will be able to use the data to re-think, re-organize and add valuable training resources to their current staff development design. This reorganization is needed so that educators are properly prepared to educate millennium students in a new-age classroom.

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CHAPTER I: INTRODUCTION

In developing a context or background for the problem statement in this study, it may be useful to reflect on a theme that Prensky (2001) articulated in one of his writings, *Digital Natives, Digital Immigrants.* In explaining this theme, Prensky (2001) observed:

> The single biggest problem facing education today is that our Digital Immigrant instructors, who speak an outdated language, that of the pre-digital age, are struggling to teach a population that speaks an entirely new language.… Against such a backdrop, our schools today are faced with the challenge of training teachers in such a way as to provide them with the skills needed to effectively teach these new "digital natives." (p.1)

According to Prensky and like-minded educational theorists and commentators, this theme encapsulates the dilemma facing our schools today and highlights the challenges inherent in it. Prensky contributes other observations to the debate as well, such as his theory that students grew up in the dark intellectually until the advent of television in the mid-twentieth century. These themes about generational change and the urgent necessity for educational reform are not without their skeptics or doubters. References to Prensky's writings are used here for their thought provoking nature, as well as his ability to shed light and question how educators might re-think their teaching methodology to effectively reach students in this digital age. Whether the technology is instant messaging (IM), video games, or cell phones, Prensky encourages teachers to get to know their students and play to the environment in which they grew up. He sees gaming theory and student interest in video games as one area for educators to explore (McHale, 2005).

Problem Statement

When you consider that computers have been in schools for over twenty years, and most teachers have participated in some type of professional development, it is still surprising to hear how many teachers do not feel competent or comfortable enough to integrate technology effectively into their classrooms.

No matter how many computers are available or how much training teachers have had, there are still substantial numbers who are "talking the talk" but not "walking the walk" (Byrom, & Bingham, 2001). We know and appreciate that there are a variety of reasons that attempt to explain why many teachers do not adopt technology integration. A few research studies indicate that some teachers have a natural inclination toward using technologies, while others do not. Moreover, like the general population, some teachers embrace change, while others resist it. However, these are broad, general statements without much empirical knowledge or research to back them up. Therefore, this study will attempt to uncover the most relevant factors that will be scrutinized and theorized through informed research.

Collins (1997) points out that there are some research-based practices and common-sense strategies that could be implemented that would enhance the likelihood that teachers begin using technology beyond an entry level stage. More specific practices and strategies will be discussed later in greater detail; however these general features listed below offer basic guidelines for effective learning experiences within the context of professional development. Collins' listing is a general research-based guide that can be applied to experiences leading to technology use, some of which are briefly described below:

Features of Effective Learning Experiences

1. Learners help plan the learning experience to fit their needs.
2. New information is received through more than one of the five senses. For example, learners may read text, hear an explanation, or view a demonstration.
3. Learners process information in more than one context and in more than one way. They may write in journals, analyze case studies, role play, hold small group discussions, conduct interviews, present lessons, solve problems, use art or music to express ideas.
4. Questions are thoughtfully and thoroughly discussed.
5. Learners are encouraged to reflect, wonder, suppose, and predict.
6. New concepts and information are related to current knowledge and experience. Learners may connect the new with the old by drawing on previous experience to illustrate new ideas; by comparing and contrasting new knowledge with previous knowledge; by applying new strategies or skills to familiar situations; by constructing metaphors for new concepts, or new information may trigger a process of deconstructing previous knowledge.
7. The learning environment is collegial. Learners learn from one another. Learners value and welcome diverse viewpoints.
8. Learners use new information over time, testing, comparing notes with other users, revising and refining understanding and practice.
9. Learners have access, when needed, to support and provide feedback from those with expertise.
10. Learners experience success.

Collins (1997) claims that when these features are incorporated into professional development, changes can occur that lead to teachers “walking the walk.” Although the listing of features lacks some specificity, it can be viewed as a general outline or guide to effective learning experiences if used in the context of applications for technology use.

Historical Perspective on Student Learning

In *Turning on the Lights*, Prensky (2008) offers some historical perspective to the notion that for most of history; kids grew up in the dark intellectually right up until about the mid-twentieth century, when television became widespread. “Kids” (students) had little idea about the world outside of their own families and neighborhoods. In terms of knowing the world you lived in, as a “kid” you were pretty much left in the dark until you got to school. Schools opened windows to the outside world and intellectual darkness gradually dissipated and became enlightenment.

Prensky (2008) asserts that as students advanced in the grades, the window opened wider, and more and more light shone in. From teachers, students learned wonderful things they knew to be true because they told you so. They taught students to read and, as a result, more of the world became available to them. The images students came across in books and the artifacts they discovered in museums broadened their knowledge. Over time, teachers taught students how to conduct experiments, test ideas and separate fact from fiction. They showed students systems and frameworks that would help them understand history, geography, mathematics, science, and their own culture, as well as others. Students were exposed to civilization's greatest accomplishments and learned

about famous men and women. They learned to think logically, structure their ideas and thoughts, and write them down for others to read and critique. Prensky (2008) observed:

> For a great many students, school was truly empowering. It exposed kids for the first time to a wide variety of useful things they knew nothing about, in ways that the students were unable to do on their own. In fact, one of the key purposes of school was to lead as many kids as possible out of the intellectual darkness into the intellectual light. That is what made being an educator a truly noble calling: Teachers were the people who showed the kids the light. Students became "plugged in and connected." We were the people who showed kids the light. (p. 41)

Prensky (2008) contends there is one big problem with this noble thought today. He says that today's "kids" already grow up in the light instead of having to be guided toward it. They are deeply immersed in it long before educators ever see them. "Kids" today are connected to the entire world around the clock, in real time, through their media and their numerous personal devices, both electronic (such as TV) and digital (such as the Internet, Facebook, YouTube, iPods, iPhones and the like. Few would argue with his observation that today's "net generation" grow up from early childhood in the so-called "light."

Prensky (2008) concedes that in the twenty-first century, young people certainly do not grow up with perfect understanding of the world; after all, they are still "kids". But he questions whether we should still characterize their intellectual state as one of ignorance and darkness and his answer is "hardly." Thanks to technology, "kids" in developed countries, especially our own, grow up knowing about, or being able to find out about, pretty much anything from the past or present that interests them. Google, Yahoo, MSN, Wikipedia, and millions of reference sites stand a mouse click away.

Long before they ever get to school, “kids” have seen a tremendous amount of the world. They have watched our troops on their satellite or cable televisions up close in far off combat zones like Iraq and Afghanistan and have seen up close the launching of space exploration missions of distant planets. They have seen wild animals up close. They have simulated racing, flying, running businesses and building cities through interactive computer games. Many have taught themselves to read through the electronic games they play. Prensky (2008) further contends:

> Given this new state of affairs, one might suppose that educators would acknowledge that today's kids grow up differently and that kids are enlightened by all their various connections to the world. Educators would figure out ways to use, build on, and strengthen students' reservoirs of knowledge. They would assume that kids will use their connections to the light to find information. "Whenever I go to school," says one student I know, "I have to power down." He's not just talking about his devices; he's talking about his brain. Schools, despite our best intentions, are leading kids away from the light. (p.42)

More recent literature challenges some of the claims made about digital natives and digital immigrants and are important in their own right. Bennett, Maton, and Kervin (2008), for example, suggest that a more measured and disinterested approach is required to investigate “digital natives” and their implications for education. Calls for major changes in education, being widely propounded, have been subjected to very little critical scrutiny, are under-theorized and lack a sound empirical basis. Thus, there is a pressing need for more theoretically informed research.

Bennett et al. (2008) argue that the debate over digital natives are based on two key elements: (1) that in fact, a distinct generation of digital natives does indeed exist; and (2)

that education must fundamentally change to meet the needs of these “digital natives.” These elements are in turn based on fundamental assumptions with weak empirical and theoretical foundations.

This continuing debate lies in part, at the heart of the critical issue confronting school administrators, instructional technology staff, and teachers today. A better understanding of the issues involved is paramount to the development of strategies for teacher professional development that fosters and encourages effective technology integration into the classroom.

Significance of the Change Process

Everett M. Rogers, a well-respected, former communications scholar, writer, teacher and best known for his “diffusion of innovations” theory and introducing the term “early adopter” states how important the change process is to the overall education process. Although his original, seminal research is several decades old, his last book is in its fifth edition and has been revised to incorporate more current knowledge on the subject. Even Roger’s seminal work, his first edition published in the 1960s, still holds major relevance and can be applied to educational technology integration today. The fact that we are still searching for effective ways to integrate technology in our schools is a reflection of how important change, innovation, and adoption techniques are to this overall discussion.

According to Rogers and Svenning (1969), if a society is one in which change is taking place at an accelerated rate, and there can be no denying that, then it of necessity follows that its component parts must also be changing at a rapid pace. Our educational systems of necessity are enamored with change. The change occurring in the other sectors

of our larger environment requires an educational system that can accommodate to these changes, as well as prepare individuals to live in a society that is changing and will continue to change at an ever-increasing rate.

Rogers (2003) theorized that innovations would spread through society as the early adopters select the technology first, followed by the majority, until a technology or innovation is common. According to Rogers, diffusion research centers on the conditions, which increase or decrease the likelihood that members of a given culture will adopt a new idea or practice. According to Rogers, people's attitude toward a new technology is a key element in its diffusion.

Roger's *innovation decision process* theory states that innovation diffusion is a process that occurs over time through five stages: Knowledge, Persuasion, Decision, Implementation, and Confirmation. Accordingly, the innovation-decision process is the process through which an individual or other decision-making unit passes: 1) from first knowledge of an innovation, 2) to forming an attitude toward the innovation, 3) to a decision to adopt or reject, 4) to implementation of the new idea, and 5) to confirmation of this decision (Rogers, 2003).

Innovation decisions in education almost always rest with what Rogers calls the "system." The school system, rather than the individual teacher, is the decision-maker. For this reason, the school administration has primary responsibility for the implementation and execution of innovation, as in providing effective teacher professional development for the integration of technology.

Rogers explains that an innovation goes through a period of slow, gradual growth before experiencing a period of relatively dramatic growth (Rogers, 2003). Following this, the innovation's rate of adoption gradually stabilizes and eventually declines. The rate of adoption is the culmination of the decision-making processes of users regarding their implementation of the innovation. Rogers established that individuals could be divided into innovation adopter types: innovators, early adopters, early majority, late majority, and laggards. He then specified that the early adopters are the key players in bringing the innovation to the point of being self-sustaining (Toledo, 2005).

Rogers further explains that many factors influence the rate at which innovations are adopted: these include their relative advantage, compatibility with current practice, complexity, "trialability," and observability of results. However, there is typically a pattern of diffusion across innovations. Rogers quantifies these groups, *innovators* (2.5%), *early adopters* (13.5%), *early majority* (34%), *late majority* (34%), and *laggards* (16%), as seen here, to demonstrate relevant proportions. Byrom (1998) extrapolates from Rogers' previous work that we can anticipate technology adoption will "take off" when ten to twenty-five percent of a given group of educators are using technology in their ongoing instructional programs (Rogers, 2003).

Obstacles to Adoption

Technology integration efforts in K-12 schools face many obstacles, including lack of human and physical support and insufficient learning opportunities (Glazer & Hannafin, 2008). Reluctance to change instructional practices has prompted resistance to

technology use in schools and has become a contributing factor to the problem. Even when learning opportunities are provided through workshops, and in-service day venues, which are the most widely used methods of staff development, many teachers report that technology activities do not transfer to classroom practices. The fact that many teachers cannot see the link between the technology and the transfer to the classroom is yet another factor contributing to the problem. One such effort by a technology coordinator put emphasis on the curriculum as a focal point, and not the technology, as a way to facilitate teacher “buy in” about the fact that technology could contribute to the classroom, and set a direction for how technology would be discussed in the schools (Dexter, Seashore, & Anderson, 2003). The literature suggests that in many cases those responsible for education technology professional development have to convince many teachers to “get on-board” with technology integration.

There has been a large infusion of technology in schools over the last several years, yet reports still indicate that many classroom computers are not being fully utilized and computer labs are still being used mainly for drill and practice activities (Smith, & Shoffner, 2001). The school leadership team and technology committee at one particular public elementary school in the southeastern part of the U.S. recognized this problem and began to investigate solutions that would foster technology integration into the curriculum. With the district's focus on accountability for results and continuous improvement, the local schools were being asked to measure the impact of technology on teaching and learning. The technology committee and school leadership team realized that the majority of the teachers did not feel they were adequately prepared to use the new technology tools in instruction. Unfortunately, not all schools recognize such problems,

do not always investigate solutions, and therefore become a factor contributing to the problem.

Wilson and Berne (1999) contend, that as a field, we know very little about what teachers learn from professional development activities. Although speaking broadly about the field of education, the same might be said of the more specific area of educational technology. They suggest action research, in which teachers document and analyze their own experiences, as an important attempt to redress this problem. They assert that this is evidence that further research is needed in this area.

Stages of Adoption

While we are beginning to recognize the principles and components necessary for program success, we do not know if teachers have progressed through specific professional development stages in the process of incorporating technology in their classrooms.

In the Apple Classrooms of Tomorrow (ACOT) research project initiated in 1985 among public schools, universities, research agencies, and Apple Computer, Inc., ACOT classrooms, students and teachers had immediate access to a wide range of technologies, including computers, videodisc players, video cameras, scanners, CD-ROM drives, modems, and online communications services. In addition, students could use an assortment of software programs and tools, including word processors, databases, spreadsheets, and graphics packages. In ACOT classrooms, technology was viewed as a tool for learning and a medium for thinking, collaborating, and communicating (Dwyer, Ringstaff & Sandholtz, 1992).

Dwyer et al. (1992) reported that the ACOT research project had been gathering data since 1986 on what happens when teachers and students have constant access to technology. The project concluded in 1998 after thirteen years. Analysis of the collective data has clarified a number of hunches about how teaching and learning change in these innovative environments, what factors inhibit change, and what support is needed to promote and sustain fundamental changes in education.

Dwyer et al. (1992) further explained that Part I of the research summarized the developmental phases ACOT teachers go through as they gradually replace their traditional beliefs and practices with new ones. Their report summarized an analysis of research findings from multiple studies and data sources collected since the beginning of the ACOT project. The analysis focused on ACOT teachers' development over a four-year period.

Dwyer et al. (1992) presented overall patterns of change experienced by the ACOT teacher group and offered a five-phase model of teacher development oriented to fundamental change in education. The five-phase model of teacher development was presented as: Entry, Adoption, Adaptation, Appropriation, and Invention level stages.

Budin (1999) suggests that these five distinct levels or stages can be characterized by the following: (1) Entry Stage - teachers are not yet comfortable with technology and do not use it. (2) Adoption Stage - teachers have mastered initial management issues but have not typically incorporated technology past occasional student drill-and-practice use. (3) Adaptation Stage - teachers use technology to speed up curriculum coverage, leaving more time for higher-order thinking. (4) Appropriation Stage - teachers understand technology well enough to use it as a tool to develop new methods of instruction

incorporating technology, and students are more actively engaged in their own learning with technology tools. (5) Invention Stage - teachers use technology to develop new learning environments.

Study Rationale

The original goal of this inquiry was to learn more about the stated problem as it relates to the first two distinct stages of teacher development above; the entry stage and the adoption stage. As a result, the expectation is that we can help teachers feel competent and comfortable enough to progress through the other stages of development where more advanced stages of integration of technology into the classroom can take place. At present, no hard empirical research, evidence, or recent reviews of the literature suggest that most teachers have reasonably graduated through the entry-level stage, except if we examine the ACOT project with more scrutiny. Current research and literature is just lacking in this area.

However, if we examine the ACOT project a bit closer, Dwyer et al., (1992) make the following observation about the entry-level stage:

> The point to acknowledge in this phase is that instructional technology already existed in each of the ACOT classrooms at the time the project began. The technology was text-based and the common tools were blackboards, textbooks, workbooks, ditto sheets, and overhead projectors. These tools were used in combination to support lecture, recitation, and seatwork. Traditional schooling was firmly in place. Teachers, who were beginning their tenure with ACOT, had little or no experience with computer technology and were in various stages of trepidation and excitement. (p.4)

It is then reasonable to assume, that since teachers in the ACOT project, although and because it was a few decades ago, and that according to Dwyer et al. (1992) teachers were already in the entry level stage as explained above, that most teachers have moved on to the adoption stage of development. Today, most teachers, being required to use electronic grade books, school email systems, internal school or other external websites for assignments, and other forms of technology, could be assumed to have arrived at the adoption stage of technology integration, or in some cases beyond.

The focus of this study will be on the second stage of development: the Adoption Stage. Special interest is focused on the understanding of the factors that improve the likelihood that teachers will integrate technology in their classrooms. An outcome of this study will be a summary of recommendations and strategies that school districts might implement to increase the likelihood that teachers master stage two and go beyond.

Because technology has advanced at such a rapid pace, it must be said that most of the relevant literature in the field, being five years or older, may be considered ancient history. Realities of technology use and integration just five or ten years ago cannot be assumed to be the status quo today. This poses a valid concern for the researcher, however current research of the literature, that is, research that is less than five years old, is ample enough to identify the problem, answer the research question, and draw conclusions or recommendations. Where the most recent literature is scarce, there are seminal works from years past, which are not just still relevant to the discussion, but are a crucial aspect of it. In order to reach the objectives of this study, the preponderance of the literature will necessarily have to come from electronic sources. One would assume that a study involving technology, although specific to educational use, would have to rely on

data from electronic sources to be as current as possible. That is the case here within the context of this study.

Researching why many teachers appear to be stuck in the second level stage would obviously be of benefit to schools in general, and in particular, those that are struggling with this problem. Newer, more innovative approaches to professional development have been emerging over the past several years. One of the promising initiatives called *GenYES*, is an innovative program that has students helping teachers use technology in classrooms, and that seems to support effective technology integration school-wide ("GenYES 2.0," 2007). *GenYES* research over the past decade claims to empower students and changes the way teachers integrate technology in their lessons. Initiatives like this hold promise that may just help answer the problem question regarding teachers' feelings of not being competent or comfortable enough to integrate technology into their classrooms.

Research Questions

(1) What are the factors that enhance the likelihood that teachers will integrate technology into their classrooms?

(2) What are the strategies utilized in examples of effective technology integration professional development models?

Definition of Terms

1. ACOT - *Apple Classrooms of Tomorrow*, a research and development collaboration among public schools, universities, research agencies, and Apple Inc. Initiated in 1985, its goal was to study how the routine use of technology by teachers and students might change teaching and learning. The ACOT research project concluded in 1998.

2. CITE - *Contemporary Issues in Technology and Teacher Education* Journal is an online, peer-reviewed journal which is the only joint venture of this kind in the field of teacher education.

3. Computer - Based Technologies - Ways to produce or deliver materials using microprocessor-based resources.

4. Competency - Knowledge, skills, or attitudes which the student can demonstrate at a pre-determined level.

5. Design - The process of specifying conditions for learning; also a domain in the field of Instructional Technology

6. Development - The process of translating the design specifications into physical form; also a domain in the field of Instructional Technology.

7. Developmental Research - The systematic study of designing, developing and evaluating instructional programs, processes and products that must meet criteria of internal consistency and effectiveness.

8. Diffusion of Innovations - The process of communicating through planned strategies for the purpose of gaining adoption.

9. Digital Natives - students today are all “native speakers” of the digital language of computers, video games and the Internet.

10. Digital Immigrants - those not born into the digital world but have, at some later point in their lives, become fascinated by and adopted many or most aspects of the new technology.

11. Distance Education - Any instructional situation in which the learner is physically distant from the point of origination, characterized by limited access to teacher and other learners.

12. Effectiveness - The extent to which the intervention accomplishes the purpose or achieves the ends desired.

13. Efficiency - Economical pursuit of ends through use of resources.

14. Evaluation - The process of determining the adequacy of instruction and learning; also a domain in the field of Instructional Technology.

15. Evaluation Research - Research that gathers data for decision making in order to prove, improve, expand, or discontinue a project, program or project.

16. Implementation - Using instructional materials or strategies in a real (not simulated) setting.

17. Instruction - Intervening in order to facilitate learning.

18. Instructional Technology - The theory and practice of design, development, utilization, management and evaluation of processes and resources for learning.

19. Instructional Strategies - Specifications for selecting and sequencing events and activities within a lesson.

20. ISTE - *National Educational Technology Standards*. A source for professional development, knowledge generation, advocacy, and leadership for innovation. A nonprofit membership organization, ISTE provides leadership and service to improve teaching, learning, and school leadership by advancing the effective use of technology in PK–12 and teacher education.

21. Learner Characteristics - Those facets of the learner's experiential background that impact the effectiveness of a learning process.

22. Learning - A relatively permanent change in a person's knowledge or behavior [or attitudes] due to experience.

23. Management - Involves processes for controlling Instructional Technology practice including planning, organizing, coordinating and supervising.

24. Multimedia - A collection of materials in several different media or a single work designed to be presented through the integrated use of more than one medium.

25. NCES - The National Center for Education Statistics (NCES), located within the U.S. Department of Education and the Institute of Education Sciences, is the primary federal entity for collecting and analyzing data related to education.

26. OET - *Office of Educational Technology*, responsible for development and implementation of educational technology policies, research projects and national technology summits.

27. Practice - Theoretical and experiential knowledge to the solution of problems.

28. Process - A series of operations or activities directed toward a particular result.

29. Professional development - giving teachers the strategies and skills they need to prepare today's students for their future.

30. Provider - Someone who is attempting to convince others to use an innovation.

31. PT3 - The Department of Education's Preparing Tomorrow's Teachers to Use Technology grant program addresses a growing challenge in modern education: many teachers still feel uncomfortable using technology in their teaching.

32. Research - Scholarly or scientific investigation or inquiry.

33. Resources - Sources of support for learning, including support systems and instructional materials and environments.

34. Technology - Systematized practical knowledge that improves productivity.

35. Technology integration - a term used by educators to describe effective uses of technology by teachers and students in K-12 and university classrooms.

36. The Partnership for 21st Century Skills - public-private organization formed in 2002 to create a model of learning that incorporates 21st century skills.

37. Theory - Concepts, constructs, principles and propositions that contribute to the body of knowledge.

38. Usage - Simple, spontaneous or planned, one time use of an instructional material or technique.

39. User - Someone who is a potential adopter of the innovation.

40. Utilization - Is the act of using processes and resources for learning.

CHAPTER II: FACTORS INFLUENCING TEACHERS' INTEGRATION OF TECHNOLOGY IN THE CLASSROOM

Whether technology should be used in schools has not been an issue in education for many years. Instead, the current emphasis is ensuring that technology is used effectively to create new opportunities for learning and to promote student achievement.

Historical Perspective

Staples, Pugach, & Himes (2005) suggest that prior to the 1990s, many schools had computers, perhaps one or two per classroom, but the flood of technology acquisition in the 1990s created a different context and opportunity for learning. One example of this new context and opportunity for learning revealed itself in one particular study, which examined the effectiveness of technology use. Wenglinsky (1998), in a large-scale study, found that students who used computers to learn mathematics, using simulations and spreadsheets, scored significantly higher on math achievement assessments than students whose only exposure was to computer-based drill-and-practice programs. Staples et al. (2005) point out that teachers and schools adhering to constructivist orientations, like using simulations and spreadsheets, seemed to reap the benefits of technology more quickly. In many schools, technology use in the classroom during the 1990s became more than just the traditional drill-and-practice methodology, taking advantage of some of the potential that computer technology had to offer.

However, even with the flood of technology in the 1990s, the U.S. Senate's Office of Technology Assessment (OTA, 1995) estimated that there were only 5.8 million

computers in classrooms by the mid-1990s, or about one for every nine students. But, throughout the rest of the decade of the twentieth century and on into the first decade of the new millennium, technology became increasingly available to more and more students at an even faster pace.

For example, the number of school-age children with access to computers at school increased 20 percent between 1997 and 2000 according to an online report by the Education Commission of the States ("What states are doing, Technology: Teacher/faculty training." 2008). In addition, a press release by the U.S. Department of Commerce after the last census, indicated that a ratio of 9-in-10 school-age children (6-to-17 years old) had access to a computer in 2000, with 4-in-5 using a computer at school. However, the U.S. Department of Commerce went on to say that the rapid increase in computer use had not been matched by increases in teacher technology training.

Major tasks for schools then, as it is today, became that of: 1) determining how technology would fit into curricula, 2) how technology would operate to strengthen student learning (Staples et al., 2005), and 3) how technology would increase teacher training to keep up with the increased demand. In the same Education Commission of the States report, the National Education Association (NEA) claimed at least 50 percent of today's teachers have not had adequate training and technical assistance in the use of technology; only 18 states require technology training as part of their teacher certification processes.

The results of the Education Commission of the States report, as well as the NEA's own research data, clearly indicate a lack of adequate training for teachers in the area of technology integration. It is therefore not so surprising to hear that many teachers do not feel competent or comfortable enough to integrate technology effectively into their classrooms. A look into whether teacher professional development (TPD) for the integration of technology into classrooms is flawed, failing in certain areas, and in need of re-thinking is justified and warranted. A good starting point for this debate is to examine the factors that enhance the likelihood that teachers will integrate technology into their classrooms.

Within the topic of *factors*, that would enhance the likelihood of teachers adopting technology integration, are two important areas or categories: 1) barriers or obstacles to technology integration, and 2) how teachers and schools deal with innovation, change and the adoption of technology integration. These are important and foundational considerations that are important to a better understanding of the main focus of this study. Therefore, a discussion of these issues will precede an examination of more specific factors found within the literature reviews. These two areas were touched upon in the introductory chapter; however it is important to go into greater detail because of their significance.

Barriers to Integration

A barrier is defined as "any condition that makes it difficult to make progress or to achieve an objective" (WordNet, 1997). Schoepp (2005) claims that the understood and

yet unspoken connotation of a barrier is that its removal acts as an aid towards the achievement of the objective. Therefore, the study of barriers as they pertain to technology integration is essential because this knowledge could provide guidance for ways to enhance technology integration.

Levin & Wadmany (2008) report that researchers often divide the barriers affecting teachers' integration of ICT into several categories. They are school-level (institutional), or first-order barriers (Ertmer, 1999); teacher-level, or second-order barriers; and system-level barriers. Balanskat, Blamire, & Kefalla (2007) further explain that each category includes a set of more specific distinct factors affecting technology use.

Ertmer (1999) claims that although teachers today recognize the importance of integrating technology into their curricula, efforts are often limited by both external (first-order) and internal (second-order) barriers. Traditionally, technology training, for both pre-service and in-service teachers, has focused on helping teachers overcome first-order barriers. Barriers to change are "the extrinsic and intrinsic factors that affect a teacher's innovation implementation efforts" (Brickner, 1995, p. xvii). Thus, first-order barriers to technology integration are described as being extrinsic to teachers and include insufficient time to plan instruction, lack of access to computers and software, and inadequate technical and administrative support, to reference a few.

In contrast, second-order barriers are intrinsic to teachers and include beliefs about teaching, beliefs about computers, established classroom practices; and unwillingness to change. While many first-order barriers may be eliminated by securing additional resources and providing computer skills training, confronting second-order barriers

requires challenging one's belief systems and the institutionalized routines of one's practice.

Ertmer (2005) also claims that while the conditions for successful technology integration finally appear to be in place including ready access to technology, increased training for teachers, and a favorable policy environment, high-level technology use is still surprisingly low. This suggests that additional barriers, specifically related to teachers' pedagogical beliefs, may be at work. Previous researchers have noted the influence of teachers' beliefs on classroom instruction specifically in math, reading, and science, yet little research has been done to establish a similar link to teachers' classroom uses of technology. More recently, training programs have incorporated pedagogical models of technology use as one means of addressing internal or second-order barriers.

Balanskat et al. (2007), in *The ICT Impact Report: A review of studies of ICT impact on schools in Europe*, note that research has identified barriers to ICT in schools in Europe. “ICT” (Information and Communications Technology) is used as an umbrella term throughout this report and has the same meaning as “IT” (Information Technology) has to research studies conducted in the U.S. in an educational context. The only real difference is that the term ICT is used more commonly outside the United States. For the purposes of this study these two terms, IT and ICT, can be used interchangeably.

Noting the factors sometimes referred to as inhibitors that impede the successful implementation of ICT in teaching, Balanskat et al. (2007) analyzed these and categorized them as:

> • Teacher-level barriers (relating to the individual): Teachers' poor ICT competence, low motivation and lack of confidence in using new technologies in teaching are significant determinants of their levels of engagement in ICT.
> • School level barriers (institutional): Limited access to ICT (due to a lack or poor organization of ICT resources), poor quality and inadequate maintenance of hardware as well as unsuitable educational software are also defining elements in teachers' levels of ICT use.
> • System-level barriers: In some countries it is the educational system itself and its rigid assessment structures that impede the integration of ICT into everyday learning activities. (p.7).

In the context of this study, teacher-level and school-level barriers are given more weight as areas of inquiry, although system-level barriers can play a significant role in technology integration by creating obstacles however unintended or by creating environments that are conducive to effective technology integration.

Becta's (British Educational Communications and Technology Agency) recent report states that teacher-level and school-level barriers could further be broadly grouped and identified, according to the literature ("What the research says about barriers to the use of ICT in teaching, "2008). Although this may be a useful distinction to make in beginning to address the subject, the literature points to a complex interrelationship between school-level and teacher-level barriers, and between the barriers within those levels.

On the basis of Becta's analysis, examples of barriers have been identified within each category ("What the research says about barriers to the use of ICT in teaching, "2008):

Teacher-level barriers:

- lack of self-confidence in using ICT (Pelgrum, 2001)
- negative experiences with ICT in the past (Snoeyink & Ertmer, 2001)
- fear of embarrassment in front of students and colleagues (Russell & Bradley, 1997)
- classroom management difficulties when using ICT (Drenoyianni & Selwood, 1998; Cox, Preston, & Cox, (1999)
- lack of the knowledge necessary to enable teachers to resolve technical problems when they occur (VanFossen, 1999)
- lack of personal change management skills (Cox et al., 1999)
- perception that technology does not enhance learning (Yuen & Ma, 2002; Preston et al., 2000)
- lack of motivation to change long-standing pedagogical practices (Snoeyink & Ertmer, 2001)
- perception of computers as complicated and difficult to use (Cox et al., 1999)

School-level barriers:

- lack of time - for both formal training and self-directed exploration (Fabry & Higgs, 1997), and for preparing ICT resources for lessons (Preston et al., 2000)
- lack of ICT equipment (Pelgrum, 2001; Guha, 2000), and the cost of acquiring, using and maintaining ICT resources (Cox et al., 1999)

- lack of access to ICT equipment due to organizational factors such as the deployment of computers in ICT labs rather than classrooms (Fabry & Higgs, 1997; Cuban, 2001)
- obsolescence of software and hardware (Preston et al., 2000)
- unreliability of equipment (Butler & Sellbom, 2002; Cuban, 2001)
- lack of technical support (Preston et al. 2000; Cox et al., 1999)
- lack of administrative support (Albaugh, 1997; Butler & Sellbom, 2002)
- lack of institutional support through leadership, planning and the involvement of teachers as well as managers in implementing change (Larner & Timberlake, 1995; Cox et al., 1999)
- lack of training differentiated according to teachers' existing ICT skill levels (Veen, 1993)
- lack of training focusing on integrating technology in the classroom rather than simply teaching basic skills (VanFossen, 1999, p.2).

The Becta analysis further points out that while the research on the barriers to effective use of ICT in general is undoubtedly important, more focused research on the barriers relating to the use of specific technologies is increasingly necessary. The reasons behind teachers' attitudes and anxieties also warrant further investigation, as does the relation between barriers to teachers' use of ICT and barriers to students' use of ICT. As technology advances and becomes ever more pervasive, it seems likely that the barriers to

its use will change. Future research in this area would most likely need to track and reflect how technological and cultural developments affect teachers' use of ICT.

How Teachers and Schools Deal with Innovation

How teachers and schools deal with innovation is another area that requires greater exploration and understanding. According to Toledo (2005) technological changes in the past quarter of a century have challenged professional educators to re-evaluate their instructional skills and to reconstruct their delivery as they assist students in integrating new technology tools. This resulting phenomenon is described by change theorist Everett M. Rogers as the diffusion of an innovation and served as the theoretical framework for those interested in learning about educational change and the adoption of innovation. Rogers (1995) defined diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). An innovation is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p. 11). Rogers contends that innovations go through a period of slow, gradual growth before experiencing a period of relatively dramatic growth. Following this, the innovation's rate of adoption gradually stabilizes and eventually declines. The rate of adoption is the culmination of the decision-making processes of users regarding their implementation of the innovation. Simply put, Rogers states that certain characteristics of an innovation itself determine how quickly adoption will occur (Rogers, 1995).

These characteristics, relative advantage, compatibility, complexity, trialability, and observability were briefly mentioned previously, but deserve greater scrutiny. Gillard et al. (2008) explain Roger's points more succinctly this way:

- ***Relative advantage*** refers to the degree to which an innovation is perceived as better than the idea it supersedes.
- ***Compatibility*** is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters.
- ***Complexity*** is the degree to which an innovation is perceived as difficult to understand and use.
- ***Trialability*** is the degree to which a user may experiment with an innovation on a limited basis.
- ***Observability*** is the degree to which the results of an innovation are visible to others (p. 24).

Innovations perceived as being only a small departure from current practices, as not too complex, that can be tried out before making a major commitment, and as compatible with current thinking will be adopted faster than their counterparts that require more thought or skill and cannot be easily observed (Rogers, 1995).

Rogers also established that individuals could be divided into innovation adopter types: innovators, early adopters, early majority, late majority, and laggards. He then specified that the early adopters are the key players in bringing the innovation to the point

of being self-sustaining. Gaible & Burns (2005) describe adopter types in the following way:

> ***Innovators*** **-** people who, by nature, always want to try new things. They like to be at the front of the process and embrace innovation. (*Innovators* are a small percentage of any group).
>
> ***Early Adopters*** **-** people who are typically opinion leaders. They have the respect of their colleagues and other teachers. These influential people are not as adventurous as innovators, but typically keep track of new ideas and initiatives to see what might be worthwhile. If they decide to use ICT, their opinions and actions will influence others around them. Though not as small in number as innovators, *Early Adopters* are also a small percentage of any group.
>
> ***Early Majority*** **-** people are a bit more conservative than the early adopters. They are "deliberate." They adopt new ideas just before the average member of any group does, but don't tend to keep track of ideas and initiatives that might be new and exciting. *Early Majority* comprises a significant portion of any group.
>
> ***Late Majority*** **-** Late majority people go along with a change, not out of belief, but out of necessity or inevitability. They are concerned about doing a good job according to existing standards and methods, so they are slow to risk a new approach. *Late Majority* represents a significant portion of any group (typically one third).
>
> ***Resistors*** **-** Resistors are highly resistant to and never accept change, preferring the status quo. A program may not be able to impact such people or may impact a small percentage of them, and then only in a marginal way.

Resistors are a small, but often very influential, percentage of any group (p. 107).

Even though innovators may be most likely to embrace change, they are not always the best models for other teachers who may think that the innovators are too innovative, different, or talented to be emulated. Instead, teachers are often more willing to follow the example of the early adopters, often considered reliable barometers of the validity of innovations and tend to be faculty leaders in other areas (Dimock, Burns, & Heath, 2001).

Gaible & Burns (2005) contend that change associated with ICT is rapid and dramatic. In contrast, people and organizations tend to resist change or embrace it slowly. Hord, Rutherford, Huling-Austin & Hall (1987) claim this tension demands the presence of a school-based or local "change agent". Johnston & Barker (2002) define a "change agent" as a person who assumes responsibility for encouraging the adoption of a technology within a particular audience. The change agent acts as an important intermediary between the originators of a technology and the intended user group. A change agent's credibility, understanding of client (school district, school, and/or teacher) needs, and the communication efforts between agent and client will all influence the rate of technology adoption. Much of the literature defines change agents as Johnston & Barker (2002) have above, a more simplified definition than Rogers gives. Rogers defines a change agent as an individual who influences clients' innovation-decisions in a direction desirable by a change agency. However, Ellsworth (2001) points out that Roger's *diffusion of innovation* theory seems to have a clear cut between the change agent and its client system. On the contrary, Ellsworth (2001) cites the conclusion of Michael Fullan, author of many works on educational change, that every stakeholder in the educational change should be viewed as a change agent.

Gaible & Burns (2005) further contend that the process of change is long and protracted with some research pointing to three to five years for change to occur. In creating and conducting professional development programs, it is important to be able to identify and understand change "types" in order to set realistic goals for teacher professional development. School leaders and on-site support staff can best help teachers and lessen their own frustration if they understand the change process. With this in mind, the following points should be kept in mind when implementing teacher professional development projects. Not every teacher will react to an innovation in the same way. Some will embrace the innovation; others will reject it. In working with teachers, it is important to understand that there are "change types" who will exhibit similar patterns of behavior toward a proposed change. Of course, not every person falls neatly into such categories, but knowledge of such change types is useful.

Linda Darling-Hammond, Professor of Education at Stanford University, respected author of over three-hundred publications on education, Principal Investigator and Co-Director of the School Redesign Network at Stanford University, a member of the National Staff Development Council Advisory Panel, and recent candidate to head the Department of Education in the new Obama administration was interviewed as part of a project on the Public Broadcasting System (PBS) called *Only a Teacher: Teachers Today*. She was asked to comment on why educational reform movements in the U.S. throughout the years have apparently failed. L. Darling-Hammond (personal communication, nd) commented that waves of reforms were tried in the 1900s, 1930s, and 1960s, but every single time reform focused on changing the curriculum, changing the management structure, changing the budgeting process, whatever, without paying

attention to helping teachers learn how to teach kids well, and therefore the reforms failed. Teachers were not enabled to use the curriculum materials, to use whatever the new innovation was that was coming down the pike, suggesting that emphasis should have been focused on effective professional development.

Darling-Hammond, L., & Friedlaender, D. (2008) further stated that lack of time to work individually with students or collaboratively with colleagues is a huge hindrance in American schools. In many other countries like France, Germany, China, Japan, and so on, teachers have 10, 15 even as much as 20 hours a week to work with one another on planning lessons, on doing demonstration lessons, on observing one another in the classroom, meeting individually with parents and students, all the stuff that enables what goes on in the classroom to be effective. In this country teachers have 3-5 hours a week for planning their lessons, period, and they do it by themselves. All of that support for developing high quality teaching and enabling kids not to fall behind is not available to them. Darling-Hammond suggests that effective change or reform can only take place when effective teacher professional development models are utilized.

Conditions Promoting Adoption

Adequate Time - for Formal Training and Self-directed Exploration

CITEd (The Center for Implementing Technology in Education) reviewed a variety of case studies related to technology integration. From these studies, they identified common challenges teachers face in their efforts to integrate technology into their curriculum and listed adequate time as first among these challenges (“Learning from

Case Studies of Technology Integration," 2008). Further, according to ("National Report on NetDay's 2005 Speak Up Event, "2006), the number one obstacle teachers face in using technology at school for professional tasks is lack of time in the school day.

Buckenmeyer (2008) and Harvey & Purnell (1995) suggest there is overwhelming sentiment that schools have yet to create the kind of training and practice time teachers need in order to learn how to effectively integrate technology into the curriculum. Although the amount of training and development time may vary according to individual teacher needs, Guhlin (1996) states the time required is whatever satisfies a teacher's need for exploratory learning. Learning includes what the teacher needs to learn to effectively use technology as both a personal and instructional tool.

Teachers must have substantial time if they are going to acquire and, in turn, transfer to the classroom the knowledge and skills necessary to effectively and completely infuse technology into their curricular areas (Vannatta & Fordham, 2004). Other researchers, Liu, Maddux, & Johnson (2004) correlated an essential seamless connection with time invested in learning and using technology and found a positive relationship with technology achievement. When time provided is inadequate or limited, teachers often resort to what they already know. Their interest and enthusiasm in exploring new pedagogical approaches using technology will therefore, wane. Time is an essential ingredient.

Scrimshaw (2004) claims that enough planning and preparation time are key to integrating ICT in day-to-day teaching. Teachers and support staff need sufficient time to get to grips with any new technology. This gives them more confidence to cope when

technology sometimes goes wrong. The more familiar they are with the technology the more they will use it.

Shelton & Jones (1996) suggest that teachers need considerable training and development time outside the school day so they can concentrate on instruction and training objectives without having to deal with the normal school day demands. The contention is that training should be provided outside or away from the normal school day–for example, at a satellite location or in an area removed from regular school activities when possible. Another alternative is to provide training either before or after school.

Individualizing Instruction

When designing staff development sessions on technology, individual differences must be addressed and individual strengths supplemented (Boe, 1989; Browne & Ritchie, 1991; Shelton & Jones, 1996). Even when professional development opportunities for technology are available, personal anxiety associated with such opportunities results because teachers arrive at the learning environment with an immense range of abilities and specific developmental needs. As a result, classroom teachers should be involved from the beginning in planning the development sessions so they can be certain their specific needs will be addressed (Guhlin, 1996).

Levin & Wadmany (2008) state that staff training programs designed for the technological development of teachers are effective when program flexibility is offered and is not based on a "one size fits all" philosophy (p. 23). Teacher training programs must not expect that all participants will leave with the knowledge and skills to facilitate

the transfer of learning to their individual classrooms. Browne & Ritchie (1991), Harvey & Purnell (1995), and Stager (1995) all agree that effective staff development for technology requires flexible content and opportunities for teacher self-selection of professional development sessions.

Jones (2004) states that having expressed the need for pedagogical training, there is evidence to suggest that there still is an important need for training teachers in specific ICT skills. Snoeyink & Ertmer (2001) suggest that the first stage of training should focus on the basic operations of technology and software applications, and once teachers have acquired the basic skills, only then should they move on to pedagogical training. Veen (1993) also suggests that training should be differentiated according to teachers' experience and skills in using computers. In this way, differing amounts of skills training could be delivered according to individual teachers' needs.

Levin & Wadmany (2008) analyzed three case studies of teachers of grades four through six over a three year period. They studied the teachers both as a group and as individual cases with the aim of exploring the relation between the changes that occurred in the teachers' educational views and practices as a result of their exposure to teaching and learning with the aid of technology and their views on factors affecting technology integration.

The findings of the studies imply that the "one size fits all" (Levin & Wadmany, 2008, p.23) metaphor is inappropriate if we are to meaningfully influence teachers' use of technology in the classroom and develop their capabilities to work in technology-based environments. In fact, the study calls for educational reformers, that is, those responsible

for the infusion of teacher technology integration in schools, to reach the right balance between working with teachers individually and working with groups of teachers.

Moreover, with reference to Cuban's claim that factors inside and outside the school affect the ability of ICT based innovation to diffuse into and improve the school, the study also added that there is a need to consider personal variables (Cuban, 2001). It demonstrates that not only should we consider the fit of technology use within the localized classroom setting of each teacher, but we should also consider the broader implications of teachers' educational beliefs, their cognitive and emotional disposition to face novel, uncertain situations, their actual teaching practices, and their views on technology and its supportive and restrictive nature.

Technology Support Staffing

Effective support that focuses on technology integration and curriculum is the primary goal of technology support staffing ("Guidance for Instructional Technology Resource Teacher and Technology Support Positions," 2008). Therefore, one of the most effective ways to align staff development with district/school goals is to invest in technology support staff that has experience in both technology and curriculum (Kinnaman, 1990). Shelton & Jones (1996), Guhlin (1996), Stager (1995), Pearson (1994), and Persky (1990) all identify the virtues of having a full-time technology director, coordinator, or resource teacher in the school or district to bring technology into the basic fabric of the curriculum.

The objective of any support organization is to create a support system that is as efficient as possible while providing strong support to its users. Unfortunately, many school districts have staff structures that have evolved informally, usually creating inefficiencies and, in some cases, cultural barriers to effective support ("Technology support index: Staffing and processes," (2009). One of the greatest challenges for an organization is distinguishing roles and responsibilities so that leadership and technical support are appropriately executed.

A school will usually have too many ICT related tasks to be undertaken by any one person ("The role of a primary school ICT coordinator", 2009). Frazier & Bailey (2008) state that in most schools and districts, the technology or ICT coordinator serves in a leadership position within the organizational structure. Many districts have preferred to keep the technology coordinator as part of the teaching staff, even though the coordinator may have supervisory responsibilities and work with adults rather than children. The actual job title varies considerably from district to district - from "coordinator" to "director" to "specialist." Regardless of the title, the responsibilities and issues that people in this position typically face are usually quite similar. However, it may be useful to examine some descriptions, roles and levels of responsibility typically assigned to technology support personnel such as technology coordinators, school-based technology specialists, and instructional technology resource teachers:

Technology Coordinator

Frazier & Bailey (2008) describe a technology coordinator as the person who blazes a trail for technology in the school or district and understands how all the hardware,

software, policies, and procedures fit together in the big picture of the school's or district's technology implementation. The technology coordinator should be prepared to help teachers, staff, administrators, and board of education members use technology more effectively and meet the standards and goals laid out in the district's technology plan. The coordinator must find and accumulate adequate funding and administrative support to make the school or district's technology initiatives feasible, as well as budget successfully for the necessary resources for installation, maintenance, and training.

School-based Technology Specialist

The title has many definitions depending where and who you ask. In the Fairfax County, (VA) public school district, for example, ("School Based Technology Specialists," 2009) the School-Based Technology Specialists (SBTS) fill many different roles in their schools, all centered on helping teachers and staff make the best use of technology to enhance student learning.

In their schools SBTS are: 1) Liaisons: acting as the liaison between the school staff and division-wide technology resources and as the technology point of contact for the school, 2) Managers: managing a wide variety of central and local accounts as well as the school's web team, the local school support team, and technology instructional assistants, 3) Trainers: developing and presenting differentiated technology training for teachers and school staff in a wide variety of instructional applications for the purpose of achieving each school's instructional goals, enhancing staff productivity, and improving student learning, 4) Consultants: acting as an on-site consultant, advising in all aspects of instructional technology and providing just-in-time support for school staff members in

the areas of curriculum connections, troubleshooting, and appropriate use of software, 5) Collaborators: collaborating with teachers in their schools to plan lessons and model best practices in integrating technology into all facets of the K - 12 curriculum, and 6) Troubleshooters: assessing software and hardware problems, implementing basic solutions, and coordinating repairs with identified service partners.

Instructional Technology Resource Teacher

Considerable thought should be given to the roles and responsibilities of the Instructional Technology Resource Teacher (ITRT). Instructional technology resource teachers are intended to serve as resources to classroom teachers, but are not intended to serve as classroom teachers. Their primary purpose is to train teachers to use technology in an effective manner. In this role they are also agents of change and actively engaged in curriculum development and lesson planning ("Guidance for Instructional Technology Resource Teacher and Technology Support Positions," 2008).

Pearson (1994) and Persky (1990) contend that having a technology resource teacher is especially beneficial for novice users, or those at the emerging stage of technological use and understanding. Novice computer users are more likely to begin integrating technology into the curriculum when they have someone to whom they can turn for knowledge about computers as well as for emotional support and reassurance. Whether this person is at the site or the district, just having someone in such a role can be a valuable asset in creating, implementing, and directing a vision for integrating technology into schools.

A recent example of the value of having someone in such a role, such as a technology resource teacher, was important enough for the Pennsylvania Department of Education to initiate a program a few years ago called *Classrooms for the Future*. *Classrooms for the Future* is an integral part of Governor Rendell's high school reform agenda designed to modernize teaching and learning in Pennsylvania by giving teachers and students access to the latest technology ("Education: Investing in a Better Future," 2009).

Classrooms for the Future will make every high school English, math, science and social studies classroom in Pennsylvania a "smart" classroom, providing laptop computers, high-speed internet access and state-of-the-art software for every teacher and student ("Education: Investing in a Better Future," 2009). This initiative includes the incorporation and in fact requirement of the inclusion of a 'technology coach' for schools receiving technology grants from the Pennsylvania Department of Education. *Classrooms for the Future* technology integration coaches will serve as part of their school's leadership team, providing "just in time," imbedded and ongoing professional development for teachers, staff, and administration ("Classrooms for the Future Coach Job Description," 2009). The *Technology Integration Coach's* primary focus will be to assist classroom teachers to successfully integrate the use of effective strategies and multiple technologies in order to differentiate and enhance student learning.

Collaborative Learning and Development

One of the most important forms of professional learning and problem solving occur in collaborative or group settings within schools and school districts and is another condition that affects adoption ("Collaboration Skills," 2009). Organized groups often

provide the type of interaction that deepens learning and interpersonal support necessary for solving problems of teaching and learning. While collaborative, face-to-face professional learning and work are the hallmarks of a school culture that assumes collective responsibility for student learning, technology is increasingly providing means for new and different forms of collaboration. One example of an environment in which effective technological development of teachers can occur is built around collaborative learning. Because teachers vary in their level of expertise at the time of their training, the context which surrounds their technological professional development must provide a non-threatening environment that is sensitive to the individual teacher's level of expertise and experience (Scrimshaw, (2004), Levin & Wadmany, (2006), Browne & Ritchie, (1991), and Shelton & Jones, (1996). Collaborative problem solving and cooperative learning can play an extremely important role in technology learning and development for teachers.

Today, technology enables teachers and administrators from around the country and world to share ideas, strategies, and tools with one another in ways that can dramatically increase the number of collaborative links among educators ("Collaboration Skills," 2009). But in order to utilize these links, teachers and administrators will face new challenges regarding learning and applying these technology tools to meet their needs.

Two more recent examples of collaborative linking in connecting educators for professional development sessions are video conferencing and “webinars”, both offering the ability to provide quality professional development . Video conferencing is a set of interactive telecommunication technologies that allow two or more locations to interact

via two-way video and audio transmissions simultaneously and offers great promise as a tool in collaborative learning. Webinars, taking the form of presentations, lectures, workshops or seminars can be transmitted over the internet and can be customizable to fit particular needs and can often cover a single topic in an hour or less. The key to video conferencing and webinars is its interactivity making these types of tools very useful.

Companies such as Renaissance Learning (http://www.renlearn.com/), providers of computer-based assessment technology for pre-K-12 schools, also offer teacher professional development symposiums, special event opportunities, and teacher professional development training online. Today, there are many other reputable companies currently offering professional development in such online collaborative formats. Although a number of other collaborative learning approaches are available, peer coaching and modeling offer two of the most effective means for transferring collaborative learning to classroom applications and practice (Joyce & Showers, 2002; Browne & Ritchie, 1991; Kinnaman, 1990; Persky, 1990).

Peer Coaching

Over the last fifteen years, a growing number of educators have come to the conclusion that the workshop and conference format that make up most staff development is sometimes, if not often, ineffective ("Peer Coaching: Changing Classroom Practice and Enhancing Student Achievement," 2008). Teachers often say that traditional professional development does not offer the sustained opportunities for collaboration, feedback, and reflection they need to change their classroom practice. At the same time, different methodologies, such as peer coaching for professional learning,

have emerged.

Peer coaching was traditionally established as a one-to-one tutoring situation, and can be very effective because it does a better job of addressing the unique learning needs of individuals (Joyce & Showers, 2002; Browne & Ritchie, 1991). Pam Robbins, in her book *How to Plan and Implement a Peer Coaching Program,* defines peer coaching as a confidential process through which two or more professional colleagues work together to reflect on current practices; expand, refine, and build new skills; share ideas; teach one another; conduct classroom research; or solve problems in the workplace. Peer coaching not only contributes to the transfer of training, but also can facilitate the development of new school norms of collegiality and experimentation.

Although peer coaching seems to be the most prominent label for this type of activity being examined here, varieties of other names are used in schools: peer support, consulting colleagues, peer sharing, and caring. These other names seem to have evolved, in some cases, out of teacher discomfort with the term *coaching*. This professional development strategy, whether called peer coaching, or by another name, generally involves experts in a particular subject area or set of teaching strategies working closely with small groups of teachers to improve classroom practice and, ultimately, student achievement. In some cases, coaches work full-time at an individual school or district; in others, they work with a variety of schools throughout the year. Most are former classroom teachers, and some keep part-time classroom duties while they coach.

Russo (2004) states that after years of disappointing results from conventional professional development efforts and under ever-increasing accountability pressures, many school districts are now hiring coaches to improve their schools. One of the most

compelling rationales for peer coaching is that many of the more conventional forms of professional development, such as conferences, lectures, and mass teacher-institute days are unpopular with educators because they are often led by outside experts who tell teachers what to do, then oftentimes there is little or no follow-up. To be effective, scores of researchers say, professional development must be ongoing, deeply embedded in teachers' classroom work with children, specific to grade levels or academic content, and focused on research-based approaches. It also must help to open classroom doors and create more collaboration and sense of community among teachers in a school.

Russo (2004) noted that when compared with other approaches; school-based coaching seems to meet many of these criteria remarkably well. It also seems to meet many of the standards set forth by the National Staff Development Council, the country's largest professional association dedicated to improving teacher professional development.

Several models of peer coaching are described below ("Peer coaching models information," 2008):

Technical Coaching

The technical coaching model is designed to help teachers transfer what is learned in a workshop environment into the world of the classroom. Technical coaching allows teachers to work together to share and apply professional strategies and techniques learning in workshops and classes. In technical coaching, teachers observe and help each other recognize how to use the newly learned strategies as effective teaching and learning tools.

Implementing technical coaching requires that teachers begin with a shared understanding of the topic and skills. It works best when schools send teams of teachers to professional-development workshops. By attending these workshops together, teachers can work together to develop the best way to implement and share the newly learned skills and strategies ("Peer coaching models information," 2008, p. 4).

Collegial Coaching

Collegial peer coaching consists of three basic parts: 1) a pre-conference, 2) an observation, and 3) a post-conference. During the pre-conference, teachers meet and discuss the elements that the teacher being observed wants to focus on. They discuss the specific lesson planned, its context, and other relevant factors that influence student outcomes. The peer coach is responsible only for providing that teacher with another perspective of the learning environment so they can mutually improve teaching and learning. Next, the peer coach observes in the teacher's classroom as a collegial observer. Finally, the peer coach schedules a post-conference, to discuss the outcome of the lesson. Collegial coaching is built on a trusting relationship between a pair of teachers that is designed to be non-competitive and mutually respectful focused on the continual improvement of their teaching methods ("Peer coaching models information," 2008, p. 2-3).

Team Coaching

Team coaching involves a teacher who is highly skilled and knowledgeable in a specific area working with another teacher to help him or her develop specific skills and

strategies. In this model both teachers plan, implement, and evaluate the success of the lesson. This means that both teachers: 1) interact with students, 2) lead instruction with students, 3) provide examples for students, 4) pose questions to the students, and 5) give instructions to students.

Team coaching means that for specific lessons there are two teachers in the classroom. Students are only aware that they have two teachers for this particular lesson. They are not aware that one of the teachers is the more knowledgeable and experienced teacher who is there to support the other efforts to learn, master, and refine a new teaching skill ("Peer coaching models information," 2008, p. 4-5).

The types of peer coaching discussed above are all very different, but they are built upon effective communication that is honest and open and based on an unbiased attitude and a willingness to help others grow professionally. Effective peer coaches must be dedicated to working in a trusting relationship with a partner to continually improve his or her teaching skills. They must also be open to new ideas and willingly share classroom experiences with their partners ("Peer coaching models information," 2008).

Mentoring

The term mentoring is oftentimes used in conjunction with or equivalent to peer coaching. However, for the sake of clarity, Gaible & Burns (2005) state that in a mentoring model, older or more experienced teachers guide and assist younger or novice teachers in all areas of teaching. Mentoring can be structured as a one-to-one approach, or as a many-to-many approach in which several mentors and less-experienced teachers work together as a team. Glazer & Hannafin (2008) state that mentors or mentor-teachers

with advanced knowledge, skill, and experience provide ongoing, just-in-time support to peer teachers as they develop and refine knowledge, skills, and resources for use in their classrooms. Initially, teacher effort is scaffolded or temporarily supported by more capable peers. Teachers receive assistance early on, and then as their proficiency increases, that support is gradually removed. In this fashion the teacher being mentored takes on more and more responsibility for his or her own learning. Through sustained implementation, teachers improve knowledge and skills related to classroom teaching practices as well as the ability to start mentoring other peers. Gradually, groups of peers develop advanced expertise, which they share among members of their teaching community.

Modeling

Gaible & Burns (2005) describe modeling as an instructional method in which teachers experience the kinds of learning that they are expected to implement in the classroom. Wepner, Bowes, & Serotkin (2007) further define modeling as a form of instruction where someone with expertise demonstrates to someone with less expertise how to use a technology application for an instructional purpose.

Modeling enables teachers to observe expert performance. It helps teachers overcome the insecurity and fear of applying what they have learned in workshops. Teachers who learn from technology support staff or other peers who model good use of technology often are less fearful and more confident about using technology in their classrooms When an expert teacher provides the instruction, the teacher-learners also have a benchmark for measuring their own progress. (Browne & Ritchie, 1991). In

addition, the practice of administrators identifying teachers with expertise in the use of technology as role models can be extremely helpful. Teachers with less experience in technology use then have a proven model in which to emulate if they wish.

Beaudin & Hadden (2005) state that faculty modeling is a major area of concern for teacher education and is necessary. Though often absent, this component of pre-service teacher preparation, is only one part of developing techno-pedagogically skilled teachers. Faculty modeling of effective technology use has often been emphasized as a key means of illustrating activities such as linking curriculum outcomes with various technologies, collaborating with others both face-to-face and virtually to achieve learning outcomes, and simulating real-world environments in teacher education programs.

Sustained Staff Development

Fox (2007) states that high-quality professional development is not only a mandate of the No Child Left Behind Act, but also a necessity if there is going to be real change in how teachers conduct lessons and collect data. In order to promote quality professional development, teachers need continual support as they work with their students to maximize available tools. As reported in his 2004 white paper, *"Meeting the Need for High Quality Teachers: e-Learning Solutions"*, the (EDC) Education Development Center's (http://main.edc.org/) Glenn Kleiman emphasizes five key features of effective professional development, as derived from various researchers. Listed as one of the key features is sustained, intensive, and continuous teacher professional development that is woven into the everyday fabric of the teaching profession, through modeling, coaching, and collaborations.

To help teachers properly complete the "learning cycle" of computer-related professional development, training must be ongoing and systematic (Kinnaman, 1990). In a study examining what hinders or promotes successful integration of technology into the middle-school curriculum, Persky (1990) noted that using technology is not easy and that learning how to effectively use technology in the context of the classroom does not happen overnight. The need to allot time for continual learning is echoed in studies outside of education, which suggest that providing workers with high technology on the job ultimately fails if employees don't receive adequate training and continuing, on-the-job support (Moursund, 1992). Further, this need for continuing support means teacher training must be ongoing and not limited to "one-shot" sessions (Hawkins & MacMillan, 1993; Kinnaman, 1990; Shelton & Jones, 1996). Harvey and Purnell (1995) state that teachers want sustained staff development rather than short-term training and development programs in technology.

Curriculum Based or Aligned Technology Integration

In a case study of the design and implementation of an introductory research course developed for a new educational technology master's program, the authors, Gerber and Scott, defined three factors that defined their curriculum design problem. These factors were: (1) the role of research in the educational technology professional's life, (2) a constructivist orientation toward learning, and (3) the role of technology in the curriculum. The latter, the role of technology in the curriculum, was an important and crucial consideration for their curriculum design and an example of aligning technology with curriculum (Gerber & Scott, 2007).

On many occasions, Gerber & Scott (2007) found themselves in the midst of focusing on features of technology and designing the curriculum around the technology. They were, in essence, privileging technology's place in curriculum design, and adapting pedagogy to the technology instead of the other way around. Although awareness of this potential challenge of designing curriculum to include technology did not prevent them from falling into traps, it did enable them to recognize when they had started down that path. They became more vigilant about explicitly articulating their assumptions and rationale for considering if and how to employ technology. Important to note is that they were also vigilant about going too far in the other direction and completely subjugating technology under pedagogy. Finding the harmony between the two extremes in which considerations of technology and considerations of pedagogy became partners in the design process was the key. K-12 schools across the country, and indeed the world, have to come to terms with the role of technology in their own curricula.

Another example of curriculum based or aligned technology integration involves pre-service teachers. Willis, Weiser, Driskell, & Hilburn (2004) claim that teacher candidates need to work in classroom environments that support technology integration in curriculum areas that will serve as models for their own future classrooms. Offering teacher candidates an opportunity to work with a curriculum that crosses grade level and content area promotes and supports technology integration and fosters the development of well planned technology-rich lessons and classroom activities.

Technological training must have an instructional focus that guides teachers to think first about their curriculum and then helps them address how to integrate technology into the curriculum (Guhlin, 1996; Persky, 1990). Teacher training often isolates technology

as a separate discipline and focuses on training for specific computer applications, such as word processing (Persky, 1990; Shelton & Jones, 1996). Focusing on this skill development, however, is problematic since it offers teachers little opportunity to transfer their learning into their classrooms (Shelton & Jones, 1996).

Pedagogical Approaches for Technology Integration

MacKinnon (2002) contends that educational goals change according to new social needs, and so do strategies for integrating technology into teaching and learning. Over the last several years, there have been disagreements among learning theorists about which strategies will prove most effective in achieving today's educational goals. This dispute has served as a catalyst for two different models of teaching and learning: *directed instruction and constructivism* (Roblyer, Edwards, & Havriluk, 1997).

Directed instruction is grounded primarily in behaviorist learning theory and the information-processing branch of the cognitive learning theories (MacKinnon, 2002). The earliest uses of computers to aid instruction based their instructional models on the work of behaviorists such as B.F. Skinner, whose followers considered that computers were able to provide drill and practice on previously learned skills. There is still obviously a place for drill and practice and other types of directed technology instruction in classrooms; however over recent years there has been a shift toward pedagogies that apply more constructivist principles. MacKinnon (2002) further states:

> that a constructivist perspective views learners as actively engaged in making meaning, and teaching with that approach looks for what students can analyze,

> investigate, collaborate, share, build and generate based on what they already know, rather than what facts, skills, and processes they can parrot. (p.2).

The constructivist approach is obviously not the only way to address learning today, but pedagogies will probably continue to change and shift as teachers try to find the most effective means to integrate technology. Other more direct approaches to teaching and learning still may have their place, but the ultimate authority rests with how teachers want to integrate technology into their pedagogies.

The model of staff development for technology should put the teacher/learner at the center of the learning experience and provide a meaningful context for learning (Stager, 1995). Teachers need instruction that engages them and forces them to reflect on the benefits and limitations of teaching with technology (Persky, 1990; Shelton & Jones, 1996). When teachers engage with others in ongoing reflection about what they have learned about the instructional use of technology, they are more likely to critically evaluate their own pedagogical practice and redesign their instruction.

Clear Administrative Message

If the technological development of teachers is to truly be effective, administrators must not simply pay lip service to the cause. They must take supportive action (ISTE NETS for Administrators Survey, 2009; Persky, 1990). Preparing teachers for schooling in this information-based society requires a new vision of teaching and associated expectations for staff development. Administrators must communicate this vision so all educators in the system understand it, and they must support teachers pursuing training in this area (ISTE NETS for Administrators Survey, 2009; Boe, 1989).

The administrative message should provide a clear, articulate philosophy regarding how the new technology will be used and how the culture of the school is likely to change. Stager (1995) states that this message must clarify the curricular content, traditions valued by the school as well as specify the outdated methodology, and content that will be replaced as technology is introduced.

In a recent *Education World* article, (Starr, 2008) states that teachers often come under fire for their failure to fully integrate technology into their classrooms. However, the author claims that very little has been said about the role of school administrators in technology integration. The article discusses how they think principals and other administrators can optimize technology use in their schools. The following quotes from a technology coordinator, technology consultant, and a webmaster for various schools were chosen because they offer different perspectives regarding the role of administrators in technology integration:

> "The most effective way school administrators can promote technology use is to themselves be knowledgeable and effective users of technology," says Betty Kistler, computer technology coordinator at Tuckahoe School in Southampton, New York. (Starr, 2008)
>
> "Principals play a big role in setting the climate of a building," agrees Cathy Chamberlain, a technology consultant in the Oswego (New York) City School District. "Teachers who are on the fence - or think they don't have time to get involved with technology - think twice when they sense a positive attitude on the part of the administration. (Starr, 2008)
>
> "I work in five elementary schools," Chamberlain explains. "In my experience, technology integration is highest in buildings in which the principal is involved

> and excited about technology and its possibilities and is lowest in buildings in which the principal doesn't demonstrate technology use while encouraging others to use it too. Modeling technology usage is key if administrators want teachers to play an active role in technology integration." (Starr, 2008)
>
> John Simeone, Webmaster at Beach Street Middle School in West Islip, New York, adds, "Staff members are more apt to use technology if administrators feel strongly about technology use for reasons that are based in fact - *not* merely on the assumption that they need to 'keep up' with other schools or districts." (Starr, 2008)

New Ways of Looking at the Problem

Upon closer examination of newer research in the field, although not as widely published as should be the case, are studies which embrace more innovative ideas about professional development. For example, it would be prudent to take a closer look into initiatives such as *GenYES*, an innovative program that has students helping teachers use technology in classrooms, supporting effective technology integration school-wide (“About Generation YES,” 2008).

Future directions that research on this subject might take could be based on the student-teacher training model offered by *GenYES*. (“About Generation YES,” 2008) claims that student-led models help to improve technology integration in many ways. By providing technical support, when needed, this helps to free up instructional technologists, peer mentors and others, who could spend time where it is truly needed, with teachers who need assistance with learning and implementing the integration of technology. Students teaching other students could also enhance technology literacy. In

terms of professional development, students teach teachers and students provide in-class support. The *GenYES* model has been around for approximately a decade now, but has been given relatively little attention in the literature. It is time to consider such innovative approaches to technology integration, and student-led professional development. Our students are our greatest asset and oftentimes more technologically competent than many teachers. Using the best asset schools already have in place to advance and help those teachers charged with the responsibility of technology integration not only makes good sense, but could be utilized immediately in most schools.

Challenging Assumptions

How can schools and districts provide the type of professional development that will promote teachers' effective use of technology in the classroom? How can this professional development inspire teachers to use technology to create new learning opportunities that will have a positive impact on student achievement? If we challenge assumptions about teachers needing more professional development, versus the type of teacher professional development, we may just find that teachers struggling with technology integration may be able to progress through, what (Budin 1999) calls the five specific professional development stages in the process of incorporating technology in their classrooms. If teachers can progress out of the “adoption stage” alone, then we will have come a long way towards advancing the cause of full technology integration.

CHAPTER III: STRATEGIES UTILIZED IN EXAMPLES OF TEACHER PROFESSIONAL DEVELOPMENT MODELS

Effective professional development, regardless of how it is delivered, needs to go beyond learning new materials and skills. It must change classroom instruction in order to have an impact on student learning (NSDC, 2001). If we concede that the research literature does in fact point toward the above as necessary ingredients to "effective" teacher professional development (TPD), then the means of delivery, approach, or model used is a key consideration as long as it meets the criteria stated above.

Sometimes we forget that teachers are learners too. They take courses, workshops, and other forms of training to fulfill recertification requirements, learn new instructional methods to infuse technology into their lessons, or keep up with changes in their specialties. Almost fifteen years ago, the U.S. Congress, Office of Technology Assessment, (OTA, 1995) reported that the approach to teacher professional development, at the time, was typically a short, in-service course on a specific topic in which a large group of teachers were gathered in one place for an "injection" of training. Even today, despite the fact that this oftentimes, stand-alone approach is limited and often disliked by teachers and administrators, is still being utilized in many schools as the sole, or primary method of TPD delivery.

This "one-size-fits-all" model of training is rarely used in other professions, and many suggest it is not the most effective way to encourage teachers to learn new skills or teaching approaches. It appears to be a particularly ill chosen method for encouraging teachers to use technology, where hands-on training with the hardware and software,

curriculum specific applications, and follow up support are all necessary. Levin & Wadmany (2008) further imply that the "one-size-fits-all" metaphor is inappropriate if we are to meaningfully influence teachers' use of technology in the classroom and develop their capabilities to work in technology-based environments. In fact, their study calls for school-based reformers to reach the right balance between working with teachers individually and working with meaningful groups/communities of teachers.

Chris Spohr, in contributing to research by Levin & Wadmany (2008) comments on “one-size-fits-all” approaches this way:

> “Highly applied, practice-oriented, participatory, and iterative: TPD is often a process of step-by-step familiarization/mastery via “learning by struggling”, and TPD initiatives are too often designed to be “one-size-fits-all”, uni-modal (i.e., lecture-based), and overly theoretical, such that teachers never obtain a working knowledge or practice new content/techniques” (p. 16)

There are significant individual differences among learners (Oblinger & Oblinger, 2005). Also, “differences in communities of school administrators, teachers, and students uniquely affect professional development processes and can strongly influence the characteristics that contribute to professional development’s effectiveness” (Guskey, 2003, p. 47). Because of these differences, and the realization that there are far too many factors to consider in developing an effective teacher professional development program, we should not suppose that a one-size-fits-all approach would ever be the most effective model to emulate. To have the greatest impact, professional development should be designed, implemented, and evaluated to meet the needs of particular teachers in particular settings and therefore several TPD approaches are likely needed. Schools may

try to implement an approach that they believe would be a fit for an entire staff, but a multi-faceted approach appears to be the most effective model.

There are many models of TPD incorporating various approaches. Prior to examining some models, it may be useful to reiterate several of the most important characteristics of high quality teacher professional development that can be derived from research on a wide variety of approaches (Guskey, 2003). To increase the likelihood of successful TPD when computers are being used, the TPD should encompass the most consistently cited factors or characteristics:

Ongoing: professional development should be continuous and include follow-up and support for further learning (Association for Supervision and Curriculum Development, 2003).

Collaborative: One of the most important forms of professional learning and problem solving occur in group settings within schools and school districts ("Collaboration Skills," 2009).

Coherent & Integrated: Professional development should incorporate experiences that are consistent with teachers' goals; aligned with standards, assessments, and other reform initiatives; and informed by the best available research evidence (Birman, Desimone, Garet, Porter, & Yoon, 2002; Guskey, 2003).

Part of Daily Work: Professional development should be largely school-based and incorporated into the day-to-day work of teachers (National Partnership for Excellence and Accountability in Teaching, nd).

Technically appropriate: Teachers should learn using hardware, systems, and applications that are the same as those they will use in their classrooms and schools (Gaible & Burns, 2005).

TPD models for technology integration will observably include other factors, however the ones referred to above, as well as factors described in greater detail previously covered in this study, are essential to incorporate in an effective model.

Further, when examining what has been learned about teacher professional development over the last decade, Gess-Newsome, Blocher, Clark, Menasco & Willis (2003) state that five general principles of effective professional development stand out:

- First, professional development needs to be grounded in the context of a teacher's classroom. This principle is based on the idea that learning is contextually bound and difficult to transfer. Learning about teaching in the context of the classroom brings the application of knowledge in clearer focus and the motivation to learn is higher (Gess-Newsome et al., 2003).
- Second, professional development must be developmentally appropriate. No two teachers are the same in their knowledge of content, instruction, and students, or in their experience in applying that knowledge to the classroom. Teachers must be supported at their current position on the journey from entry level to the invention stage development (Budin, 1999). Professional development must start with the teacher and build on her/his current concept of teaching and learning and his/her goals and needs.

- Third, professional development takes time. If there is an advantage of thinking of teaching as a skill, it is that training can happen quickly, often in a relatively short period of time. But when teaching is recognized as a profession with the goal of developing expert knowledge, it becomes understandable why achieving professional development goals often takes several years of sustained effort to significantly impact classroom instruction (Hall & Hord, 2001).
- Fourth, professional development must contain the elements that promote learning, such as an active and social environment that promotes change, and transfer. Of particular importance is the role of collaboration in professional development. In nearly all studies of professional growth and change in classroom teaching, the presence of collaboration is the most consistent predictor of success (Holland, 2001; Hunter, 2001; Windschitl & Sahl, 2002).
- Finally, professional development must allow teachers to take charge of their own professional growth. As professionals, and like all learners, teachers will only be impacted by those ideas in which they deliberately choose to engage. Teachers must be afforded the respect to set their own course of development and be encouraged to actively monitor their own progress.

Based on the literature, it should be clear that teacher professional development is a process and not an event (Hall & Hord, 2001). The challenge to professional development is not so much the number of teachers that need to be impacted, although important, but should include: (1) the commitment of time for sustained interaction, (2)

the presentation of new ideas or experiences that challenge those current conceptions, and (3) the support needed to help teachers change their thinking about teaching and learning and put into place instructional practices that mirror those new beliefs.

One of the chief goals of professional development, then, is to help teachers master the knowledge base of teaching and to make deliberate instructional decisions that will result in student learning (Gess-Newsome et al., 2003). When adding the challenge of integrating information technologies into professional development, it becomes a more complex issue. The infusion of technology should not act as a cure-all for the challenges of professional development. Technology is said to be simply a tool that can enable a learner to interact with content and, perhaps, other learners. How this tool is utilized is a very important consideration.

As stated by the National Staff Development Council (2001), technology can either reinforce the diffusion of knowledge or liberate learning opportunities. The way we use technology in professional development, and teaching of any type, speaks volumes to our views of knowledge, expertise, teaching, learning, and the role of teachers in schools.

Gess-Newsome et al. (2003) further contend that professional development is a perennial challenge in education. With the advent of technology, we have added to our arsenal of alternative tools to help us in meeting this challenge. However, in addition to our increased access to technological tools, we have a research base in teaching, learning, expertise, and professional development that can help us examine how to best capitalize on technology to improve student learning. Gess-Newsome et al. (2003) articulated this new challenge this way:

> Our new challenge is to assess carefully the impacts of the infusion of technology into teacher professional development through research, document those results, and use them to inform future efforts so that we may positively impact teacher and student learning. (p.337)

Teacher Professional Development Models

Gaible & Burns (2005) state that teachers need a wide variety of ongoing opportunities to improve their skills. TPD, sometimes referred to as "in-service" or "teacher education", is the instruction provided to teachers to promote their development in a certain area, in this case, technology integration. TPD can be the tool by which policymakers convey broad visions, provide guidance to teachers, and disseminate critical information. An understanding of teachers' needs and their work environments - schools and classrooms, is where effective TPD should begin. Then TPD should combine a range of techniques to promote learning; provide teachers with the support they need; engage school leadership; and make use of evaluation to increase its impact.

When computers and other digital technology are involved, TPD programs should address not only teachers' technical skills, but also their concerns about how to use computers with students, and about risks to their status in the classroom. Successful computer-supported or computer-focused TPD provides teachers with hands-on opportunities to build technical skills and work in teams while engaging them in activities that have substantial bearing on their classroom practices or on other aspects of the school workplace (Gaible & Burns, 2005).

TPD can be divided into three broad categories, according to Gaible & Burns, (2005):

Standardized TPD - The most centralized approach, best used to disseminate information and skills among large teacher populations; Focused on rapid dissemination of specific skills and content, often through a "cascade" or "train-the-trainer" approach.

Site-based or School-centered TPD - Site-based or school-centered teacher professional development is focused on longer-term change processes, usually via locally facilitated activities that build on-site communities of practice. It is usually characterized by intensive learning by groups of teachers in a school, district or region to promote profound and long-term changes in instructional methods.

Self-directed or Individual TPD - Independent learning, sometimes initiated at the learner's discretion, using available resources that include computers and other digital technologies such as the internet and other online resources like online tutorials and webinars; Focused on individualized, self-guided TPD with little formal structure or support.

Standardized TPD

Gaible & Burns (2005) explain that standardized TPD typically represents a centralized approach, involving training sessions, workshops, and in many cases what is know as the "Cascade" model of delivery. Standardized models tend to rely on training-based approaches, in which presenters share skills and knowledge with large groups of educators via face-to-face, broadcast, or online means. Training-based models are

frequently employed to develop ICT skills such as those covered by the International Computer Drivers License (ICDL). ICDL (http://www.icdlus.com/) is the world's largest end-user computer skills certification program, and global standard in end-user computer skills. Training-based models are also used to introduce the integration of computers into curricula, as in the “Intel Teach to the Future” program (http://www.intel.com/education/teach/index.htm?iid=ed_nav+teach).

The Intel Teach program offers a range of face-to-face and online offerings designed to enable teachers to introduce, expand and support 21st century learning. They also offer free online tools and resources for educators that support collaborative student-centered learning. To date, the program has trained more than five million teachers in more than 40 countries, and is committed to reaching 13 million teachers by the year 2011.

Gaible & Burns (2005) contend that standardized, training-based approaches should focus on the exploration of an idea and the demonstration and modeling of skills. Standardized approaches can effectively expose teachers to new ideas, new ways of doing things, and new colleagues; disseminate knowledge and instructional methods to teachers throughout a district, region or country; and visibly demonstrate the commitment of a school district or school to a particular course of action.

Often however, workshops take place at one time and in one location without follow-up, and without helping teachers build the range of skills needed to use new techniques when they return to their schools. These one-time sessions can certainly help introduce and build awareness about computers, learner-centered instruction, or new curricula. However, training without support rarely result in effective changes in teaching and learning, or in adoption of full and effective technology integration at the school level.

Utilizing standardized TPD should be considered when trying to disseminate information to the largest number of teachers possible and in introducing teachers to computers, the Internet, and strategies for using these tools. It should also be considered to build awareness of best practices and to expose teachers to new knowledge, skills, strategies and individuals. When conditions are such that expert knowledge is scarce due to inadequate resources or other factors, such is the case in many rural areas, additional follow-up should be provided on-site in schools.

The Cascade Model (Standardized TPD)

In the Cascade model, one or two teachers from a school receive standardized TPD by means of a training-based model and return to their schools to replicate the training that they have received (Gaible & Burns, 2005). They serve as what has become known as "champion teachers" or a "vanguard team." Cascade approaches are often used to help teachers learn basic computer skills and to integrate computers into teaching and learning.

Although the scale of cascade-based TPD is potentially tremendous, according to Gaible & Burns, (2005), weaknesses in the approach may limit its effectiveness. Weaknesses may include: workshops that typically focus on helping champion teachers learn new techniques as *users,* without helping them build the skills they need as *professional-development providers; s*trong challenges for champion teachers due to a lack of both TPD for school leaders, and programs that motivate teachers to participate in

programs that produce champion teachers who may lack the leadership, skills and mastery of the new techniques they need to guide their colleagues effectively. Despite these potential weaknesses, cascade-based TPD has its place when utilized properly.

TaiwanICDF Teacher Professional Development Program

The following model is a government- endorsed (Dominican Republic Ministry of Education) program which laid the foundation for the TaiwanICDF-World Links professional development partnership program and integration of ICT into classrooms in the Dominican Republic ("TaiwanICDF Teacher Professional Development Program," 2009). This model has been used in other developing countries throughout the world.

The aim of this project, as is the aim of all World Links programs, is to contribute by narrowing the digital divide through promoting the effective use of technologies in teaching and learning in poor schools in the targeted countries that would otherwise remain behind. It provides participating schools with global best practices in training, technology, educational resources, and evaluation tools to enable them prepare disadvantaged youth for a new economy ("TaiwanICDF Teacher Professional Development Program," 2009).

Specifically, the TaiwanICDF Teacher Professional Development Program consisted of four phases: 1) Introduction to the Internet for Teaching and Learning, 2) Tele-collaborative Learning Projects, 3) Curriculum and Technology Integration, and 4) Innovation, Tech, Pedagogy and Professional Development. For all phases, the *Master Trainers,* who completed five-day workshops, continued on to local schools to conduct

the same workshops for a total of 108 teachers. These teachers subsequently trained 165 additional teachers. Following the World Links' cascade model, the number of teachers trained and students reached had risen, even after the termination of funding, as teachers continued to employ their skills and knowledge by training and sharing their skills with fellow teachers in local schools. Thus, this model's impact in the educational systems of participating, developing countries has been deep by changing and improving the way teachers teach with the use of ICT ("TaiwanICDF Teacher Professional Development Program," 2009).

According to the World Links website (http://www.world-links.org/), the program has not only trained teachers and changed pedagogy in the Dominican Republic, but has changed the attitudes of teachers and students towards learning. With the new tools that technology provides, teachers and students became excited about the learning process and expanding their worldview. With the collaborative projects, the shape of the classroom had changed. The classroom was no longer local, but international, with students discovering peers all over the world. Participants claim that what happened in the Dominican Republic during the life of this project and beyond was truly exciting because of the improvements to education and attitudes that it had positively shaped.

Site-based TPD

Site-based TPD most often takes place in schools, resource centers or teacher training colleges. Teachers work with local, "in house" facilitators or master teachers to engage in more gradual processes of learning, and building mastery of pedagogy, content and technology skills. Site-based TPD often focuses on the specific, situational problems that

individual teachers encounter as they try to implement new techniques (Gaible & Burns, 2005).

Site-based TPD models are intended to: 1) bring people together to address local issues and needs over a period of time, 2) encourage individual initiative and collaborative approaches to problems, 3) allow more flexible, sustained and intensive TPD, and 4) provide ongoing opportunities for professional learning among a group of teachers at the local school or district level. However, site-based approaches can be very time and labor-intensive, which also give rise to challenges.

Site-based approaches require locally-based TPD providers skilled in facilitation, instruction, content, curriculum, assessment, and technology. Facilitators also should be adept at helping teachers succeed in low-resource environments where it would be particularly challenging to integrate technology even at a minimal level. Establishing and maintaining a network of such facilitators to meet the needs of TPD programs can be challenging in any environment.

Despite these challenges, site-based TPD should be part of any long-term professional development planning for educational improvement. Since TPD should be viewed as a long-term approach, it is constructive to think of teacher professional development as a continuous process, and not simply a time-bound activity or series of events (MacNeil, 2004). Initially, such programs may be expensive while local TPD providers are being deployed and developed. However, once site-based programs are in place, new methods of technology integration, curricula, pedagogies, tools, and administrative practices can be introduced in a more cost-effective manner.

According to Gaible & Burns (2005), schools and school districts should consider using site-based TPD when:

- Changing instructional practices is critical
- Plans call for a significant enhancement of teachers' subject knowledge or of classroom teaching and learning
- Objectives include ongoing growth toward overall excellence in teaching and learning
- There is a core group of teachers from each school able to participate in professional development
- Technology can be used to supplement professional development
- Facilitators or master teachers can be developed regionally at teacher training colleges or at schools (p.22)

Site-based methods can supplement and provide follow-up for standardized methods. For example, new assessment methods can be introduced at regional or nationwide workshops to facilitators and teachers. These facilitators will then return to their schools and work onsite with their colleagues to implement the new techniques.

Site-based (school-centered) Model

This example of a site-based model originated from a newly created technology position known as "learning technologies director", with the responsibility of leading the strategic planning process of a suburban Chicago school district's technology plan. The task force, responsible for the creation and implementation of the plan, decided early on that the focus was to be on what students did with technology rather than just on acquiring the technology itself (Moffitt, 2000).

In the midst of the planning process and after having identified the major goals, it became clear that the task force's proposed instructional model, in which students would become more actively engaged in their own learning, would require the roles of teachers to change significantly across all twenty-eight schools in the district. Despite this realization, members agreed that this was the direction they wanted to take.

The plan called for the "learning technologies facilitator" to spend time on integrating technology into instructional practices rather than being a technical troubleshooter. In order to achieve this goal, a help desk system was designed. Originally staffed on a rotating basis, a full-time person was soon assigned. Technicians were added over the first three years in accordance with guidelines for personnel growth. Technicians were given responsibility for a set of schools, but in addition, were told they had to become an "expert resource" on a different aspect of technology.

The plan also called for the initiation of a site-based position of technology troubleshooter. The district's network director managed this group of school staff interested in learning more about technical aspects of the district's new network and technology tools. Staff was compensated on an hourly basis as needed, and usually spent their time after school dealing with minor issues. The district also instituted student technology teams to help teachers and other students learn basic skills and troubleshooting tips, such as hooking up a projection device or what to do if a printer jams.

More specific to professional development, technology integration classes that focused on modeling were offered during the day, with substitute teachers provided. In addition, classes were offered after school, in the evenings, and on Saturdays to

accommodate faculty and office staff. Incentives in the form of software packages for home use for every fifteen hours completed were added for attending multiple sessions. School-based facilitators initially taught the training classes, but over time, additional in-house staff became competent enough to assist and then conduct classes on their own. Eventually, each school employed instructional technology coordinators who worked closely with the "learning technologies facilitator" to plan professional development that connected learning and technology.

After just two years, the district managed to network all of their schools and equipped each learning space, including gymnasiums and all other staff offices. Each school used their individual budgets to acquire additional equipment as needed. The ratio of computers to students also dramatically changed by the end of the third year of the plan making it one computer for each student district-wide.

As is the case in many school districts who try to implement aggressive technology integration plans, one of the greatest hurdles was to get the teaching staff to see the technology staff as collaborators, and not adversaries. Building possible relationships between the two groups was of paramount importance. The technology staff encouraged teachers to have fun in the process of learning new tools for teaching and learning, and eventually most teachers raised their comfort level with using technology in the classroom. At the end of only a few short years, this district was able to claim that their strategy was benefitting students and teachers alike in a very positive way (Moffitt, 2000).

Self-directed TPD Model

Knowles, Holton, & Swanson (1998) state that all adults eventually have the desire to be self-directed learners; thus, adults strive to be more involved with managing the learning process. The self-directed learning model states that the need for this independence increases with age and a person's experience.

An underlying assumption to this self-directed model assumes that individuals can best judge their own learning needs and that they are capable of self-direction and self-initiated learning. It also assumes that adults learn most efficiently when they initiate and plan their learning activities rather than spending their time in activities that are less relevant than those they would design. However, when individual teachers design their own learning there is sometimes much "reinventing of the wheel," which may cause inefficiency. The model also holds that individuals will be most motivated when they select their own learning goals based on their personal assessment of their needs (Sparks & Loucks-Horsley, 1989).

Teachers learn many things on their own. They read professional publications online, have discussions with colleagues in person or online through blogs, experiment with new instructional strategies found on educational websites, involve themselves in online classes or tutoring, among many other activities. All of these may occur with or without the existence of a formal staff development program. It is possible, however, for staff development programs to actively promote individually-guided or self-directed activities. While the actual activities may vary widely, the key characteristic of the individually-guided staff development model is that the learning is designed by the teacher. The

teacher determines his or her own goals and selects the activities that will result in the achievement of those goals.

Theorists and learning-style researchers recognize that the circumstances most suitable for one person's professional development may be quite different from those that promote another individual's growth. Consequently, individually-guided staff development allows teachers to find answers to self-selected professional problems using their preferred modes of learning. Rogers' (1969) client-centered therapy and views on education are based on the premise that human beings will seek growth given the appropriate conditions. "I have come to feel," Rogers wrote, "that the only learning which significantly influences behavior is self-discovered, self-appropriated learning" (p. 153).

Summary

Effective professional development, regardless of how it is delivered, needs to go beyond learning new materials and skills. The strategies, means of delivery, or models identified in this chapter all meet the criteria of going beyond just learning new materials and skills, although part of the overall strategies for effective teacher professional development for the integration of technology (NSDC, 2001).

Since teachers remain the gatekeepers for students' access to educational opportunities afforded by technology, providing technical skills training to teachers in the use of technology is not enough as has been emphasized many times. Teachers also need professional development in the pedagogical application of those skills to improve teaching and learning (Carlson, 2002).

The three broad categories discussed: standardized, site-based, and self-directed TPD,

when implemented appropriately, usually most effectively as a combined overall strategy according to district or individual school needs, have the potential to enhance the likelihood that teachers integrate technology into their classrooms (Gaible & Burns, 2005).

CHAPTER IV: RECOMMENDATIONS AND SUMMARY

A critical part of the rationale for this study is to identify, analyze, and then recommend a course of action regarding the two research questions: 1) What are the factors that enhance the likelihood that teachers will integrate technology into their classrooms? and 2) What are the strategies utilized in examples of effective technology integration professional development models?

In the first instance, this study has identified, analyzed, and categorized factors that should comprise an effective teacher professional development plan that would enhance the likelihood that teachers integrate technology. Factors were grouped into themes: Barriers to adoption; Stages of adoption; How schools deal with innovation; and Conditions promoting adoption.

Relative to the second research question, different models of TPD were also identified, analyzed, and categorized: Standardized; School or site-centered; and Self-directed models. Examples of these and their strategies to promote effective TPD were examined and now recommendations follow. In this chapter, recommendations are offered that have the potential to positively impact and improve schools' teacher professional development plans designed to integrate technology into classrooms.

Eliminate or Reduce Barriers to Adoption of Effective TPD

Other fields, such as medicine and the military, do a far better job of providing ongoing learning opportunities and support for their professionals. In education, professional learning in its current state is poorly conceived and deeply flawed, according

to a recent report by the National Staff Development Council (NSDC) and School Redesign Network at Stanford University (Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009). Teachers lack time and opportunities to observe each other's classrooms, learn from mentors and coaches, and work collaboratively. Current TPD methodology has been called into question: "The support and training they (teachers) receive is often sporadic, narrow-minded, and meaningless. Meanwhile, states and districts are spending millions of dollars on academic courses disengaged from the realities of classrooms, but little on helping educators find solutions to the day-to-day challenges they face" (Wei et al., 2009, p. 2).

It is suggested that it is time for our education workforce to engage in learning the way other professionals do; continually, collaboratively, and on the job in order to address common problems and crucial challenges where they work. The report further contends that the United States is squandering a significant opportunity to influence improvements in teacher development to improve school and student performance. Other nations have made support for teachers a top priority with significant results.

Adopting recommendations can be likened to adopting innovation; the school system, rather than the individual teacher, is the decision-maker, thus the school administration has primary responsibility for the implementation and execution of recommendations or for decisions not to adopt. The following recommendations point to some basic principles for designing professional learning that school and district leaders and policymakers would be well advised to consider.

Criteria used to determine these recommendations are based on the potential to have the greatest impact on the promotion of effective teacher professional development

regarding technology integration, if implemented. However, one must keep in mind the probability is that even if recommendations are deemed worthy of consideration and implemented, today's education system is heavily entrenched with a bureaucracy-like structure that is extremely difficult to penetrate and usually change comes slowly and gradually, if at all.

Recommendations Relative to School (Institutional) Barriers

More Time for Professional Learning

Ample time for professional learning has already been described as being extrinsic to teachers and classified as a first-order barrier (Ertmer, 1999). One of the key structural supports for teacher engagement in professional development is the allocation of time in the work day and week to participate in such developmental activities.

In most European and Asian countries, instruction takes up less than half of a teacher's working time (National Commission on Teaching and America's Future, 2005). The rest - generally about 15 to 20 hours per week is spent on tasks related to teaching, such as preparing lessons, marking papers, meeting with students and parents, and collaborating with colleagues American teachers spend much more time teaching students and have significantly less time to plan and collaborate with colleagues than teachers in other nations. Teachers in the U.S. spend approximately 80 percent of their total working time engaged in classroom instruction, leaving much less time for important tasks that could promote essential professional development (Wei et al., 2009).

Schools would do well to model more of a European/Asian approach to time allocation for teachers setting them free to work on continuing, on-going and sustained

activities on a daily and weekly basis for professional growth and development. If implemented, this increased time outside of direct classroom instruction should include mentoring and coaching as a top priority - teachers working collaboratively has proven to be to be an effective tool despite the limited amount of time afforded American teachers. The European/Asian model has proven to have great success in improving teacher learning and recent assessments of student achievement bear it out, according to the most current reports and literature reviews (Wei et al., 2009).

Clear Administrative Message and Support

Principals and other administrators can and should optimize technology use in their schools. Unfortunately, administrators oftentimes simply pay lip service to the cause. Preparing teachers for schooling in this information-based society requires a new vision of teaching and associated expectations for staff development. Administrators, including technology support staff, must communicate this vision so all educators in the system understand it, and they must support teachers pursuing training in this area. The administrative message should provide a clear, articulate philosophy regarding how the new technology will be used and how the culture of the school is likely to change. One of the most effective ways school administrators can promote technology use is to themselves be knowledgeable and effective users of technology and, in effect, model to the rest of the staff**.**

Allow Teachers More Influence in School Decision-Making

U.S. teachers should be allowed and encouraged to have more input and influence in school decision-making, particularly in the area of designing their own professional learning. In many high-achieving nations where teacher collaboration is the norm, teachers have substantial influence on school-based decisions, and in the design of their own professional learning. Strizek, Pittsonberger, Riordan, Lyter & Orlofsky (2006) note that in the United States, however, less than one-fourth of teachers feel they have great influence over school decisions and policies as noted in the 2003-04 national *Schools and Staffing Survey* (SASS).

While a slim majority of teachers across the nation feel that they have some influence over curriculum and setting performance standards for students, fewer than half perceived that they had some influence over the content of their in-service professional development. A worthy goal would be to increase the role that teachers have in decision-making as it relates to professional development. In doing so, educators will become more invested as stake-holders in the overall process leading to better overall performance of schools.

Individualize TPD Instruction

While it is highly improbable, or even impossible to individualize all forms of TPD, when designing staff development sessions on utilizing technology in the classroom, individual differences must be addressed and individual strengths supplemented wherever possible (Boe, 1989; Browne & Ritchie, 1991; Shelton & Jones, 1996). There is a lack of

training differentiated according to teachers' existing ICT skill levels contends Veen (1993). To avoid a "one-size-fits-all" approach, which has been rightfully criticized in the literature for the most part, classroom teachers should be involved from the beginning in planning the development sessions so they can be certain their specific needs will be addressed (Guhlin, 1996). Training programs that take varying needs into account might identify teachers' current interests and needs before the instructional session; provide training geared to the identified needs of the target audience of teachers; supplement participating teachers' strengths; and promote diversified instructional strategies to fit the various learning styles.

Make TPD Sustained and On-going

Schools should make TPD ongoing; connected to practice; focused on the teaching and learning of specific content; connected to other school initiatives; and build strong working relationships among teachers. However, most teachers in the United States do not have access to professional development that uniformly meets all these criteria.

Other nations that outperform the United States on international assessments invest heavily in professional learning and build time for ongoing, sustained teacher development into teachers' work hours. When time for professional development is built into teachers' schedules, their learning activities can be ongoing and sustained and can focus on a particular issue or problem over time (Wei et al., 2009).

The teaching profession is constantly changing; therefore it is important for teachers to be continuous learners. Effective professional development should occur throughout the school year, not just during one-shot workshops or summer sessions. Teachers must

have frequent opportunities for in-depth and active learning that is authentic and useful in their daily practice.

Recommendations Relative to Teacher-level Barriers

Noted previously by Balanskat et al., (2007), teacher-level or second-order barriers are intrinsic to teachers and include, but not limited to beliefs about teaching, beliefs about computers and digital technology, established classroom practices; and unwillingness to change. Although these kinds of barriers may be harder to eliminate than school-level barriers because they require change in the individual, strategies utilizing elements of collaborative learning or development have proven promising when applied. These barriers are significant determinants of teachers' levels of engagement in ICT and include: lack of self-confidence in using ICT (Pelgrum, 2001); negative experiences with ICT in the past (Snoeyink & Ertmer, 2001); fear of embarrassment in front of students and colleagues (Russell & Bradley, 1997); perception that technology does not enhance learning (Yuen & Ma, 2002; Preston et al., 2000); lack of motivation to change long-standing pedagogical practices (Snoeyink & Ertmer, 2001); and the perception of computers and digital technology as complicated and difficult to use (Cox et al., 1999).

According to Levin & Wadmany (2008), confronting second-order barriers requires challenging teachers' belief systems and the institutionalized routines of their practice. However, when viewed within the teacher's broader belief profile and knowledge restructuring processes, doubts, uncertainty, and lack of confidence can be regarded as an acceptable and normal part of a teacher's professional development. Comfort with uncertainty strongly relates to the ability to use technology innovatively. Further, Dudley-

Marling & Fine (1997) conclude that for teachers who are learners "uncertainty is what keeps the inquiry process going" (p. 252), and therefore uncertainty encourages growth and renewal. Therefore, administrators and technology support staff should not only be aware of this research about personal teacher-level barriers, but also be able to apply what the literature has uncovered so far in order to comfort teachers in the knowledge that their uncertainty is normal and a part of the learning process. This approach has the potential to reduce teacher anxiety and lack of confidence about utilizing technology in the classroom and encourages teachers by showing there is a support structure in place to meet their needs.

Recommendations Relative to System-level Barriers

State Initiatives to Support Technology Support Staffing

One of the greatest challenges for an organization is distinguishing roles and responsibilities so that leadership and technical support are appropriately executed. Since effective support that focuses on technology integration and curriculum is the primary goal of technology support staffing (“Guidance for Instructional Technology Resource Teacher and Technology Support Positions,” 2008), one of the most effective ways to align staff development with district/school goals is to invest in technology support staff that has experience in both technology and curriculum (Kinnaman, 1990). In particular, technology integration coaches should be utilized in all schools whenever and wherever possible.

In order to meet this goal, states should implement initiatives similar to the *Classrooms for the Future* model used in Pennsylvania. The inclusion of "technology coaches" for schools receiving technology grants from the state is in effect. These coaches will serve as part of their school's leadership team, providing "just in time," imbedded and ongoing professional development for teachers, staff, and administration. The coaches' primary focus will be to assist classroom teachers to successfully integrate the use of effective strategies and multiple technologies ("Education: Investing in a Better Future," 2009).

Recommendations Relative to Strategies Incorporated in Models of TPD

Collaborative Learning

Given the prevalence of an "egg-crate model" of instruction, whereby each teacher spends most of the day in a single room, separated from other adults, the American teaching profession has not yet developed a strong tradition of professional collaboration (Wei et al., 2009, p.11), but should. Historically, schools have been structured so that teachers work alone, rarely given time together to plan lessons, share instructional practices, assess students, design curriculum, or help make administrative or managerial decisions. Several national studies on what distinguishes high-performing schools from their lower-performing counterparts consistently identify effective school-wide collaborative professional learning as critical to the school's success.

U.S. teachers participate in workshops and short-term professional development events at similar levels as teachers in other nations. Nevertheless, the United States is far

behind in providing public school teachers with opportunities to participate in extended learning opportunities and productive collaborative communities (Wei et al., 2009). Those are the opportunities that allow teachers to work together on issues of instructional planning, learn from one another through mentoring or peer coaching, conduct research on the outcomes of classroom practices, and collectively guide curriculum and professional learning decisions. Because teachers often encounter barriers when they attempt innovation in their schools, professional development programs should include structures that support collaboration among teachers.

Coaching

In recent years, many schools and districts across the country have invested in school-based coaching programs, one of the fastest growing forms of professional development. Coaching models recognize that if professional development is to take root in teachers' practice, on-going and specific follow-up is necessary to help teachers incorporate new knowledge and skills into classroom practice both in the short and long term (Guskey, 2000; Garet et al., 2001). Many experts note that successful coaching should be offered by accomplished peers and should include "ongoing classroom modeling, supportive critiques of practice, and specific observations" (Poglinco, Bach, Hovde, Rosenblum, Saunders, & Supovitz, 2003); Joyce & Showers, 2002).

Several comparison-group studies have found that teachers who receive coaching are more likely to enact the desired teaching practices and apply them more appropriately than teachers receiving more traditional professional development (Neufeld & Roper,

2003). All school TPD plans ought to include a significant portion devoted to forms of coaching.

Modeling

Gaible & Burns, (2005) define modeling as a form of instruction where someone with expertise demonstrates to someone with less expertise how to use a technology application for an instructional purpose. Modeling enables teachers to observe expert performance. It helps teachers overcome the insecurity and fear of applying what they have learned in workshops, or other forms of TPD. Teachers who learn from technology support staff or other peers who model good use of technology often are less fearful and more confident about using technology in their classrooms. Modeling should be an important component to any TPD.

Mentoring

Wei et al. (2009) report that much of the professional development available today focuses on a growing attention to mentoring support. Mentoring is usually associated with new teachers and often serves as their primary source of professional development for the first few years of their careers. Various forms of new teacher induction are now required in more than thirty states.

However, teachers assessed at a lower level of technology skills or ones lacking confidence in their technological abilities could benefit from mentoring. Mentoring is considered the kind of high-intensity, job-embedded collaborative learning that can be very effective, or minimally has shown to hold much promise, yet not a common feature

of professional development across most states, districts, and schools in the United States.

Typically in such models, administrators identify well-regarded veteran educators and assign them to provide ongoing guidance, advice, and mentoring to a group or groups of teachers to help them improve their instruction. Some studies suggest that when teacher mentors receive formal training, along with release time to provide one-to-one mentoring, the retention and classroom performance of beginning or newer teachers improves (Smith & Ingersoll, 2004; Olebe, 2001). Further, a recent literature review noted that a number of case-based research studies give strong support to mentoring programs that are "collegial" and "job-embedded", as when mentors observe teachers in the classroom, while finding that workshops for new teachers tend to be ineffective (Wang, Odell, & Schwille, 2008). Mentoring should be an important component to any school coaching plan and increases the effectiveness of the overall collaborative learning model.

Student-centered Support System Initiatives

Previously, a promising initiative called *GenYES* was examined for the possible role that a student-centered, student-led support system might have on teacher professional development for the advancement of technology integration ("GenYES 2.0," 2007). Students helping out in schools is not a new idea, but in the context of an additional tool to enhance the likelihood that teachers will use technology integration in the classroom, it could be described as an under-used and fairly untapped resource.

Little research has been done in this area to date. However, those responsible for school or district TPD would do well to examine the positive attributes of such a relatively simple, yet cost effective addition to their arsenal of tools for the infusion of classroom technology. Many schools have successful student "*tech"* teams, but initiatives like *GenYES* go far beyond just establishing student technology teams. In most schools with a student "*tech*" team, the club advisor has to create the curriculum by themselves and figure out how to run the student team with no help. By implementing a program like *GenYES*, teachers receive the support of a community of educators using an exemplary model, one that has been proven by research to improve school-wide technology integration.

According to their website (http://genyes.com/), and other reviews about this specific initiative (Chuang & Thompson, 2006), *GenYES* provides an easy to use, proven program that provides professional development for teachers infusing technology and at the same time improves student achievement. Their curriculum, combined with online tools and services, provides a student-led support system for every teacher who wants to use more technology in their classrooms and reaches far beyond just fixing things. *GenYES* addresses the core reason why teachers do not use technology in their classroom by providing more than just tech support. *GenYES* students help teachers see technology working in their own classrooms, with their existing technology, with their real students.

Instead of having teachers take online courses or attend workshops or college courses for professional development, this program, sometimes referred to as reverse-mentoring, makes it possible for students to mentor teachers and serve as resources at the teachers' schools. Chuang & Thompson (2006) state that most student-centered programs pair one

student with one teacher to provide individual technology tutoring, but decisions on how to utilize these student mentors are left up to administrators or the technology support staff.

The *GenYES* model trains students to provide continual on-site content-related technology support to teachers. Using students to mentor teachers is a powerful way to capitalize on intergenerational differences with respect to computer and technology use. Students become a force for change as they share leadership roles and accomplishments with teachers and school administrators.

Summary

Focus on the problem statement and answering the research questions were central to the foundation of this study. Ultimately, this enabled the study to development recommendations that can be beneficial to schools responsible for strategies to enhance the likelihood that teachers integrate technology into their classrooms.

The premise upon which this study was conceived centered around a theme that arose time and again during previous research in the area of technology integration. Repeatedly, research kept suggesting that most teachers wanted to learn to use educational technology effectively, and received some type of professional development training, but many still did not feel competent, comfortable or lacked the support necessary to do so. Consequently, several questions arose from the original premise giving birth to this project.

This study contributes to the limited research in the field in several ways and supports many of the findings of the research in the area of educational technology use. It should be

noted that there is a limited amount of research on the specific topics covered here. In part, that is why the research questions were chosen. Although much has been written about teacher professional development in general, gaps remain in the literature relative to that portion of professional development dedicated to technology integration in our schools.

This study contributes to the research by: 1) identifying and examining factors that enhance the likelihood that teachers will integrate technology into their classrooms, 2) identifying and examining strategies utilized in models of education technology professional development, and 3) offering recommendations that will promote the use of technology integration in the classroom.

Factors were identified that would have an effect on enhancing the likelihood that teachers use technology in their classrooms. Since the research uncovered many factors, they were categorized into themes: Significance of the change process, Stages of adoption, obstacles or barriers to adoption, and Conditions promoting adoption. These represent the main areas discussed relative to the first research question.

Technology has been in schools for many years to one degree or another, yet there is still a continuing debate about how best to get teachers to integrate it seamlessly into the curriculum. Innovation decisions in education almost always rest with what Rogers (2003) calls the “system” and therefore the challenge has fallen primarily on the shoulders of administrators and technology support staff as members of the “system” to accomplish this goal. Further, Roger’s diffusion research centers on the conditions which increase or decrease the likelihood that a new idea or practice will be adopted, therefore an understanding of the significance of the change process is crucial.

The five-stage adoption model (Budin, 1999) has been identified and discussed in this study with emphasis on the adoption stage. Rogers characterizes adoption, in his *innovation decision process theory* as the third step in the stage towards diffusing innovation. The sequence is described as: 1) from first knowledge of an innovation, 2) to forming an attitude toward the innovation, 3) to a decision to adopt or reject, 4) to implementation of the new idea, and 5) to confirmation of this decision (Rogers, 2003). An understanding of this model forms the basis of adapting strategies to promote technology integration among teachers.

Teacher-level, school-level, and to a lesser degree, system-level barriers were identified as obstacles to adoption of effective professional development. Emphasis was placed on first-order, extrinsic, or school-level barriers, since removal or at least a reduction of these kinds of obstacles would have a greater chance of success for implementing effective technology integration than the other level barriers. However, attention to aspects of teacher-level and system-level barriers should not be discounted. For instance, if collaborative learning strategies help to create teacher confidence, it could be considered successful in eliminating a second-level, intrinsic barrier. Likewise, if a particular state or federal government policy or reform helped to alleviate obstacles, it could be considered a system-level barrier. The fact that they are considered in a particular classification does not matter. What really matters is the elimination of barriers with little concern over how they are grouped.

Conditions promoting adoption were partially identified by extrapolating what positive factors would look like once barriers were removed. For instance, if time were eliminated as a barrier, there would likely be many residual effects. There would be

adequate time for teachers to receive on-site, collaborative learning such as peer coaching, mentoring, and modeling that the research suggests are effective tools. Other conditions for promoting adoption were identified because they have to become integral parts of any effective teacher professional development plan. These included such conditions as having an effective technology support staff, making staff development on-going and sustained, and having administrators deliver clear messages.

The preponderance of research suggests that there is not a “one-size-fits-all” strategy, approach, or model that would help teachers infuse or integrate technology into classrooms. Rather, many strategies should be taken into account because of the variables involved in learning and the individual goals of schools implementing policies.

This study has identified and examined teacher professional development models and strategies categorized as: 1) Standardized or Traditional TPD, 2) Site-based or school-centered TPD, and 3) Self-directed or Individual TPD. Although standardized or traditional TPD, mostly thought of as in-service “workshops”, may still have a limited role, research suggests this the least effective model and should be used quite sparingly. On the other end, self-directed TPD has the potential to bridge gaps between the traditional and school-centered TPD, however usually has little formal structure or support and oftentimes is not utilized effectively except when administrators or support staff encourage it. Oftentimes, teachers have to be guided into and shown self-directed approaches that could be used.

Site-based or school-centered teacher professional development is focused on longer-term change processes, usually via locally facilitated activities that build on-site communities of practice. It is usually characterized by intensive learning by groups of

teachers in a school, district or region to promote profound and long-term changes in instructional methods.

The recommendations put forth in this study, like the factors chosen and emphasized to promote the adoption of effective TPD plans, are provided because they may have the potential for greatest impact on promoting technology integration. However, they are not without obstacles of their own, but could be minimized in such a way as to prove effective. For example, administrators would most likely have to be creative and resourceful, nevertheless if they offered teachers time during the school day to devote to collaborative learning, according to the literature, it would be an extremely powerful tool. Whether administrators or technology support staff could approach day-to-day teacher scheduling in a new way to accommodate such innovative approaches is problematic. However, the adoption of new models or approaches require a re-thinking, or re-examining process. The diffusion of innovation and the change process itself (Rogers, 2003) require that those responsible for TPD in the area of classroom technology integration, start thinking in newer, more innovative ways.

Clearly some schools have been more creative and innovative than others. Some schools have had more success than others. Ideally, it would be useful to have one TPD model that combines various strategies proven to be effective and could be implemented in all states, districts and schools. However, the reality is that schools will have to continue to implement their own TPD models based on various factors and concerns pertinent to their own experiences.

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